Winnebago Reclamation Service, Inc.

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P.O. Box 2071 Loves Park, Illinois 61130 Office: 815/877-9561

Landfill: 815/874-7375

January 19, 1988

OCT 26 1990

REMEDIAL & ENFORCEMENT RESPONSE BRANCH

Mr. Jim Hill Warzyn Engineering 1409 Emil St. P.O. Box 9538 Madison, WI 53715

Dear Jim:

Enclosed you will find material entitled Activity 3A.1 Landfill Operation for your study.

Very truly yours,

Winnebago Reclamation Service, Inc.

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WINNEBAGO RECLAMATION SERVICE'S

PAGEL'S PIT LANDFILL SITE SUMMARY OF OPERATIONS

- I. Liner
- II. Placing Waste
- III. Compaction of Waste
 - IV. Cover
 - V. Leachate Collection
- VI. Leachate Pumping Logs
- VII. Landfill Gas Extraction
- VIII. Reference Tabs

LINER

The Winnebago Reclamation Landfill (Pagel's Landfill) was constructed in 1972 on the site of a former sand and gravel quarry. The design of the facility was patterned after similar asphalt or coal-tar lined landfills in operation in Pennsylvania. No wastes were disposed of at the facility prior to the date on which the landfill commenced operation under the Illinois EPA operating permit.

In the first stage of the construction of the landfill the sides and floor of the quarry were graded and compacted. Next, two inches of "hot-mix" asphaltic concrete was laid over the sides and floor of the site and compacted. The asphalt laid on the sides of the landfill was compacted using vibratory rollers which were pulled up the side using a crane. The finished walls are approximately thirty-five feet high and slope at a ratio of 3:1.

After the asphalt base was laid and compacted over the floor and sides, the surface of the asphalt was sealed with one layer of emulsified asphalt and two layers of cationic coal tar sealer. The tar seal prevents damage to the liner from naptha or other similar solvents.

Finally, the sealed asphalt liner was covered with eight inches of sand. A network of 6-inch perforated asbestos pipe was laid in this sand as a leachate collection system. The pipe itself rests in one-inch diameter washed aggregate to enhance the efficiency of the leachate collection system.

LINER-pg. 2

Because the sand and gravel in which the leachate collection system is laid is more permeable than the compacted refuse, the sand covering over the sealed asphalt liner prevents the accumulation of leachate against the liner.

The entire landfill site is enclosed with cyclone fencing.

Access to the site is permitted only through a secure gate which is monitored during all hours of operation.

PLACING WASTE

All wastes enter the site through a gate-controlled entry, which includes a certified truck scale facility. Within the facility, wastes are transported by truck on an internal roadway system to the working face of the landfill. When a new cell is started, wastes are dumped off the sides of these roads and pushed downward. Through this process, the first lift in each cell is a minimum of 10 feet thick so that equipment does not come into direct contact with the sand layer or the liner. The wastes are pushed straight out from the top of each cell to prevent any large items in the wastes from coming in contact with the liner.

COMPACTION OF WASTE

The landfill has used a variety of compaction equipment, mostly track-type machines because of their versatility, traction, and availability.

In the first few years of landfill operation, a D9 crawler (100,000 lb. GVW) and two Case 1150 crawlers (31,400 lb. GVW) were used. Those machines were replaced in the mid to late 1970's by a John Deere 750 crawler (31,375 lb. GVW) and a Caterpillar 816 wheel-type compactor (45,877 lb. GVW).

From the late 1970's to 1986, the John Deere 750, Caterpillar 816, and a Caterpillar D8 (72,000 lb. GVW) were used. At present, the landfill utilizes a John Deere 646 (34,490 lb. GVW) wheel-type compactor and a Liebherr 641 (48,400 lb. GVW) track-type loader.

The operating weights and specifications for the equipment used can be found in Tab #2.

Covering methods have varied according to the quarry operations conducted at the quarry located near the landfill. Initially, soil and bank run sand taken from the early operation of the nearby "Rockview Stone" quarry were used as fill. A mixture of sand and gravel and dirt has always made up the majority of the cover used.

For a number of years limestone was also being quarried at the site and depending on how close it was to the active cell, or depending on the weather conditions, shot rock was used for cover or to build up haul roads. Presently the landfill is hauling in its cover by truck from two quarries adjacent to the landfill site. The material from these two sites is mostly a sand-clay with some gravel in it.

The cover has been placed mostly with a rubber-tired endloader, but depending on stripping or excavating on site, some cover is placed with Terex TS 24 scrapers or a D8 crawler tractor pulling a 14 cubic yard scraper.

Whenever a particular area is filled to the planned elevation it is then covered with a final cover of 2 feet of clay excavated from a borrow area off site.

The clay is placed and shaped to assure good drainage and six inches of topsoil is added to promote good vegetative growth. The soil is tested and PH is corrected with Agricultural lime and is fertilized, seeded with a Hydroseeder and mulched with straw to prevent erosion.

LEACHATE COLLECTION

The bottom of the landfill liner is graded to drain to various manholes placed throughout the landfill. A leachate collection system consisting of a network of 6" perforated asbestos pipe connected to the manholes is embedded in sand for protection to itself and the liner. The pipe itself is surrounded by 1" washed aggregate to allow flow of leachate into the perforations.

Leachate is also now collected from the landfill gas extraction wells located throughout the landfill. Slimline pumps that fit in the 6" to 8" diameter wells are lowered to the bottom of the wells. There are eight pumps that are moved to different locations as they become dry.

All pumps, from the wells and manholes are pumped to a holding pond where the leachate is aerated until it is loaded on a tanker-truck and hauled to the Sanitary District of Rockford.

A cross section of the liner, underdrain pipe, sand blanket and tires can be seen in Tab #3.

For pumping capacities see Tab #4.

LEACHATE PUMPING LOGS

From the beginning of construction of the landfill the leachate has always been collected at the manholes and pumped with Flyght 3" submersible pumps onto a tank truck. With the addition of the gas extraction system, the gas well enabled the landfill to remove water from areas all over the landfill by lowering slimline 1-1/2" submersible pumps into the wells and pumping it to the leachate pond. Logs are maintained detailing which wells are pumped and for what length of time.

The specifications on the pumps used and a sample of the well logs are available in Tab #4.

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LANDFILL GAS EXTRACTION

Landfill gas migration studies were performed by Warzyn in 1980 and 1981, as a result a gas extraction system was built on the east end of the site.

Those reports can be found in Tab #5 and #6.

In 1984 an extensive gas extraction system made up of over 70 vertical wells was installed as well as a gas processing plant with the intention of supplying clean, dry, gas to a grain to alcohol plant and later to a sewage sludge dehydrator.

Today the primary extraction system can be run seperately to a torch where the gas is burned, and the main system is supplying over 23,000,000 BTU of gas per day to the sludge dehydrator.

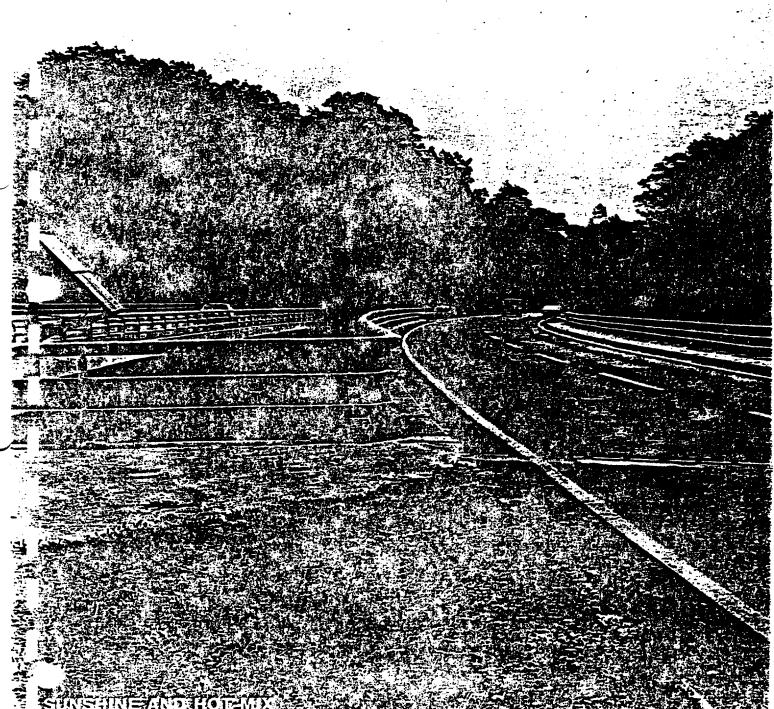
Typical drawings of the wells, water traps, and the topographical drawing of the landfill with the wells and our numbering systems labeled on them can be seen in Tab #7.

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NATIONAL ASPHALT PAVEMENT ASSOCIATION FALL 1977



SUNSTREAD HOLDS - TO TO THE MEAN OF THE PARTY OF T



Lanchester Corporation's landfill facility demonstrates the application of the hot-mix asphalt liner. At left (light area) is the prepared subgrade ready for paving. At right is the hot-mix liner with the 14 inches of clean earth atop (near background) and the landfill materials being placed atop it (right rear).

Hot-Mix Keeps Landfills Sanitary

anitary landfills are sites for the disposal of waste liquid and solid materials, there to slowly decompose safely and out of sight. One big problem with sanitary landfills is keeping them sanitary. Precautions must be taken to avoid any contamination from waste materials getting into the surrounding environment, particularly creeks,

rivers and ground waters.

The State of Pennsylvania is taking large strides in the development and construction of proper sanitary landfill sites, and one of their quality innovations has been the use of hot-mix asphalt as a landfill liner. Hot-mix is proving to be an ideal barrier material, to keep liquids in or liquids out; in the case of sanitary landfills, it does both.

Hot-mix makes the perfect liner for the landfills because it is easy to put down, follows the contours of the land, is not subject to breakthrough from compacted objects (as many films and fabrics are) and makes a liquidtight seal. This latter point is especially important in the containing of leachate, a liquid residue which accumulates from the landfill operations and is, in many cases, collected and traited before release into waterways o. used as a wetting-down agent for new andfill.

Another important Pennsylvania delopment has been the usage of a standard highway wearing course, ID-2 (see table for composition), for the ladfill liner paving. Although this mixture is not a "hydraulic" mix and does not meet permeability uirements, this is overcome by thing it with a seal of AC-20 applied at a quantity of 0.6 gallon per square y d in two applications of 0.3 gallon per square yard each.

By formulating this mixture around the Pennsylvania Department of I insportation ID-2 specifications, the Pennsylvania Department of Environmental Resources (which has ji isdiction over sanitary landfills) is a ured of receiving quality material and workmanship and also led to an emomic advantage since contractors a dealing with a familiar mix.

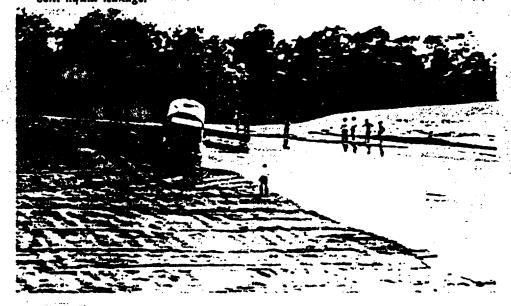
leader in the concept of quality
1 will operations is Lewis R. Frame,
owner of the Lanchester Corporation's
sing near Honey Brook, Pa., (about 40
1 les northeast of Philadelphia). The
commercial Lanchester operation
covers some 525 acres in all and has
1 m in operation approximately 18
1 unths. At expected rate of use (about
2,500 tons of refuse accepted per day),
i useful life will be approximately 25
3 ars.

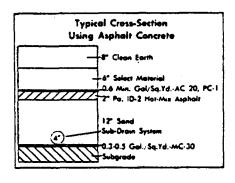
"From the start, I thought the key ment in a landfill operation was to the job right," Lew Frame said. "Since I intend to be in business for a long time, want my facility to be an set, not a detriment to the communiand also have to meet especially stringent environmental conlerations, it was imperative that no rners be cut in our operation. Since this facility will also be handling Lazardous materials, it was also essenil that quality and care be used ighout." How well he's succeeded i. .. is goals can be seen by the fact that has received numerous writeups in ... agazines and newspapers commenting on the quality of his operation, us received visitations from en-

Pa. — Wearing — ID-2			
Passing Sieve	Required Composition		
. 1/2"	100		
3/8*	80-100		
4	45-80		
8	30-60		
16	20-45		
30	10-35		
50	5-25		
100	4-14		
200	3-10		
Bitumen, % By Weight			
Stone	4.5-8.0		
Slag	7.0-10.5		



(Above) Paved landfill site near Bloomsburg, Pa., ready for landfill operations to begin. (Below) Sealing the hot-mix liner with a spray application of AC-20 to prevent liquid leakage.







(Above left) Cross-section of typical landfill liner using hot-mix asphalt. (Above right) Overview of Lanchester Corporation's facility. The site covers approximately 525 acres and is expected to have a useful lifetime for landfilling of 25 years after which it will be developed as a golf course and recreational facility.

vironmental groups, delegations from other communities and groups from the surrounding area (including school children).

To date, four landfill sites in Pennsylvania have used hot-mix asphalt

Discussing the Lanchester landfill operation are (from left): Carl W. Lubold, Jr., District Engineer, The Asphalt Institute; Lewis R. Frame, Owner of the Lanchester Corporation facility; and Edward J. Siodlowski, Executive Secretary, Pennsylvania Asphalt Pavement Association.

liners and the Lanchester operation illustrated the high-type design considerations being employed.

top the prepared subgrade (see sketch) and 12 inches of sand, two inches of Pennsylvania type ID-2 hot-mix is placed. This is then sprayed with the AC-20 seal and 14 inches of clean earth and select material are placed atop the hot-mix liner for the leachate collection system. Any leachate runoff is piped to a collection point (generally a leachate lagoon) where it is treated and recirculated/discharged.

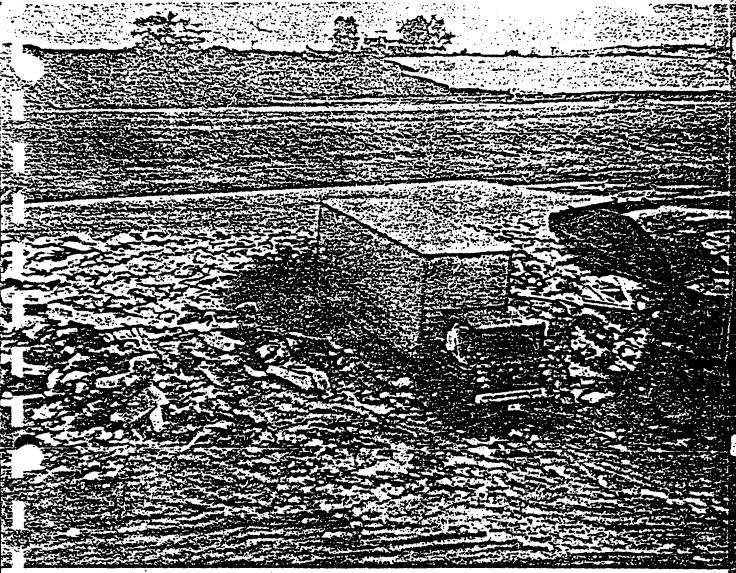
Several of the landfill operations in Pennsylvania have also paved their treatment ponds with hot-mix both as a moisture barrier and for the ease in cleaning. Pond liner thicknesses have normally been from three to four inches compacted thickness with a 0.25 gallon per square yard liquid asphalt seal.

"It is absolutely essential that our landfills improve our environment, not add problems to it," John Rosso, Chief Engineer, Solid Wastes Management, Pennsylvania Department of Environmental Resources, said, "and we feel that the Honey Brook operation is an outstanding example of taking a quality approach to all facets of the operation and one that others are encouraged to follow."

On Lewis Frame's business card it says "Pennsylvania's Most Sophisticated Landfill." It could also add "Best."



PAVING FORUM/8



AN OVERALL VIEW of the sanitary landfill shows the various stages of development. On the ground level residue is being eliminated from a Rockford collector into the already prepared

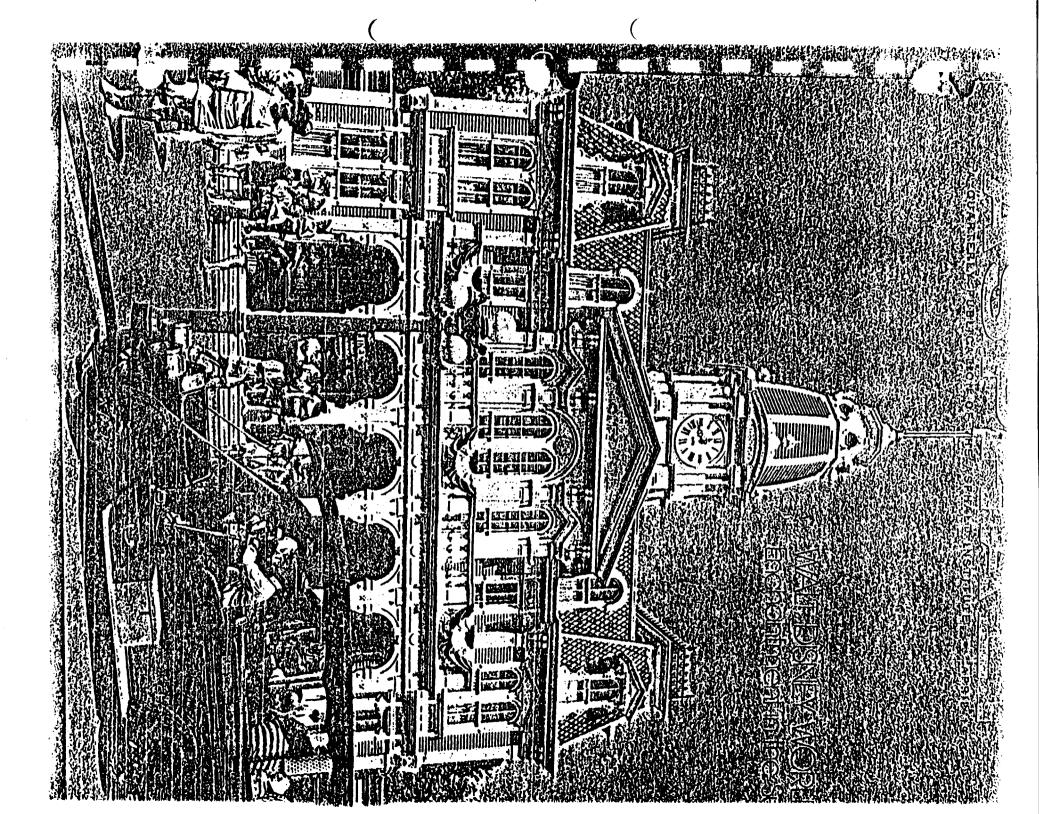


THE ASPHALT LINING of the sanitary landfill is extended as needed. It consists of two inches of coal-mix which is sealed with an application for emulsified asphalt and one of tar emulsion.

pit. In the background slope paving is in progress on another segment on the huge pit.



AN ASPHALT DIKE on the inside edge of the paved area is used to contain leachate until the paved area is extended throughout the full length of the pit.



How to dispose of waste without desecrating the land and dirtying the environment is a dilemma faced by almost every city and town in the nation today. Rockford, Illinois, through the ingenuity of Rockford Black Top Construction Co., is facing up to the problem by converting otherwise unusable land into a sanitary landfill that eventually will serve as a recreation area or some other useful purpose.

The site selected was an abandoned gravel pit and adjacent rock quarry. A farm pond paved by in-place asphalt mixing gave the contractor, Rockford Black Top Construction Co., owner of the two excavations, the idea of turning them into a landfill. The company decided to seek permission to build one on the strength of the fine performance of the pond lining.

The Illinois Environmental Protection Agency, passing on the suitability of asphalt lining for preventing contamination of ground water, approved the project in the summer of 1972. Rockford's next step was to obtain a permit from the Winnebago County Zoning Board to use the land as a sanitary fill. Its selling point was that the land would be reclaimed by fill material and covered with soil to enable other uses. The permit was readily granted.

Tackling the gravel pit first, Rockford Black Top Construction Co. paved a section of it last year. As waste accumulates and sections of the pit fill up, new segments are opened and paved as needed. Eventually, the landfill will include the adjacent rockquarry.

Before placing the lining, Rockford's crews graded the bottom and side slopes of the pit. Rainfall or leachate flows to a ditch, thence to a perforated pipe for collection in a 20,000-gallon steel tank. Contents of the tank are pumped back over the fill to accelerate deterioration of the material.

Two inches of hot asphalt mix (using 200-300 penetration asphalt cement) line the bottom and side slopes of the first paved area. The contractor in-

stalled an asphalt dike along the inside edge of the pavement to prevent leachate from running off and contaminating soil in unpaved areas. A tar emulsion sealer protects the lining against naphtha or other solvents which might inadvertently be dumped in the fill. Six inches of sand cover the bottom and side slopes.

To pave the extension of the bottom and side slopes Rockford switched to an asphalt cold-mix prepared at a plant located in the rock quarry. The 2-inch lining is composed of crushed rock, sand and 6 to 6½ percent of a medium-setting cationic emulsified asphalt. The plant turns out approximately 130 tons of mix per hour. After again placing an asphalt dike along the inside edge of the paved area, workmen sealed the lining with one application of 0.25 gallon per square yard of the emulsified asphalt and two 0.25 gallon per square yard applications of tar emulsion. Bottom and side slopes then received 6 inches of sand. Two miles of 6-foot chain link fence have been erected, 1½ miles of road paved with asphalt concrete and a scale house built as a part of the project.

The landfill, now called the Winnebago County Land Reclamation Site, serves a population of about 200,000. Trucks dump from 500 to 600 tons of waste each day. Four monitoring wells are strategically located on the site so ground water can be checked for contamination.

So successful is the landfill, the Rockford Black Top Construction Co. has received a letter from the Illinois Environmental Protection Agency lauding the project.

From his office in Springfield, III., Mr. Hill provides Asphalt Institute engineering services in Illinois and St. Louis County, Mr. He joined the Institute in 1958 as District Engineer after serving as a materials engineer with the Kansas Highway Commission.

* Leachate—soluble constituents in combination with water comprising the material leached to the bottom lining.

Highway Contractor Puts It All Together For Ecology

Rockford Black Top Construction Company Cited By Environmental Protection Agency

By A. D. HILL
District Engineer
The Asphalt Institute

Pave old gravel pit town gets sanitary land fill

By A. D. Hill Illinois District Engineer The Asphalt Institute

A thin layer of asphalt pavement that prevents Ilquids from soaking into surrounding soils and gravels has turned an abandoned gravel pit into a sanitary land fill.

Rockford Black Top Construction
Co. Rockford, Ill., has received the
blessing of the Illinois Environmental, Protection Agency, the thanks
of a small city and a number of villages, and has done itself a favor
as well. The gravel pit (and a
worked out: quarry) were both
owned by the company, but seemed
to have no potential value. The
sanitary land fill operation will not
only be viable itself but the pits
where backfilled and after the
garbage has rotted will become
useful plots of level land.

The company got the idea from watching the performance of a farm pond, paved with mixed in place asphalt. The lining of the pond performed so well, that Rockford Black: Top realized that they could overcome the most important objection to a sanitary land fill, that of polluting nearby groundwater. The Illinois Environmental Protection Agency, passing on the suitability of asphalt lining for preventing contamination of groundwater, approved the project in the summer of 1972. The contractor's next step was to obtain a permit from the Winnebago County Zoning Board to use the land as a sanitary filla:lts selling point was that the land would be reclaimed by fill material and covered with soil to enable other uses. The permit was readily granted. ...

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Two in, of hot asphalt mix (using 200-300 penetration asphalt cement) line the bottom and side slopes of the first paved area. The contractor installed an asphalt dike along the inside edge of the pavement to prevent leachate from running off and contaminating soil in unpaved areas. A tar emulsion sealer protects the lining against naphtha or other solvents which might inadvertently be dumped in the fill. Six in, of sand covers the bottom and side slopes.

To pave the extension of the bottom and side slopes the black-top company switched to an asphalt coldmix prepared at a plant located in the rock quarry. The 2-in, lining is composed of crushed rock, sand and 6 to 6½ percent of a medium-setting cationic emulsified asphalt. The plant turns out approximately

130 tons of mix per hour. After again placing an asphalt dike along the inside edge of the paved area, workmen sealed the lining with one application of 0.25 gal per sq yd of the emulsified asphalt and two 0.25 gal per sq yd applications of tar emulsion. Bottom and side slopes then received 6 in of sand.

Two miles of 6-ft chain link fence have been erected, 1½ miles of road paved with asphalt concrete and a scale house built as a part of the project.

The land fill, now called the Winnebago County Land Reclamation. Site, serves a population of about 200,000. Trucks dump from 500 to 600 tons of waste each day. Four monitoring wells are strategically located on the site so groundwater can be checked for contamination.

More information on material mentioned is available by circling appropriate reader service number in this

429 Asphalt

2'THICK ASPHALT LINING

ASPHALT DIRE

DRAINAGE SYSTEM

TISSES

SUMP

Section through old gravel pit with asphalt lining on bottom and side slopes. This was covered with a 6 in, deep layer of sand before placing refuse in pit.

104



Asphalt-lined: Stavel pit solves disposal problem

Recirculated leachate speeds decomposition of refuse sand cover keeps vermin away

a If you need landfill sites and have an abandoned gravel pit in the area, your problem may be solved: Worried about leachates? Don't. You can turn them into an aid to decomposition if you follow the example of Rockford, Ill. (pop. 147,000), and the Rockford Black Top Construction Co.

The construction firm suggested to the city and the Environmental Protection Agency (EPA) that an acceptable landfill area could be developed in an old 60-acre gravel pit it owned. By lining the pit with asphalt and tar sealer, leachate would not escape into the water table. Investigation and negotiations led to a contract with the city to safely dispose of its refuse for \$5.95 per ton.

Basin constructed

The firm invested approximately \$500,000 and spent about three months grading part of the 35-foot deep pit into the shape of a large bowl. Three sides were paved with a hot plant-mix asphalt. The remaining side was treated with a cationic asphalt emulsion as an experiment.

To line all but the lower onesixth of the 3:1 slopes, work crews dumped the hot material along the upper edge and then bulldozed it downward. The lower portion of the slopes were paved by pushing the asphalt up from the bottom. A small vibratory roller, connected to a crane that pulled it up the slope, compacted the material.

Standard paving procedures were used to pave the bottom. A lip or dike constructed around the top edge of the bowl prevents water from getting behind the asphalt liner.

Totally developed, the project will cost an estimated \$750,000. This includes additional grading and lining of five other parts or "cells" in the pit, fencing and reforestation around the area. A buffer zone of agricultural land 200 feet wide surrounds the disposal area.

Unlike other landfills that seek to eliminate leachates, this one recirculates the liquid to aid in decomposing the refuse. Liquid waste products collect in a 10,000-gal tank at the bottom of the pit and are pumped to the top for recirculation. Excess leachates are trucked to the Rockford Sanitary District plant for treatment.

"We use sand as cover because it is available at the site and it permits the recycled leachate to get through to the refuse," said Chuck Howard, the landfill operator. "Besides, sand is good for keeping rats away. They can't dig in sand because it keeps closing in on them."

Winters can be cold in Rockford, but according to Bill Howard, Jr., president of Rockford Black Top, there is little chance of frost heave destroying the lining. He attributes this to the war temperatures of the decomposir garbage.

Checks made

A series of wells have bee placed around the pit to check to leachate entering the soil. Thesare checked by EPA personne and should there be any danger the groundwater the company permit, which was granted Api 1973 on an experimental basi would be withdrawn.

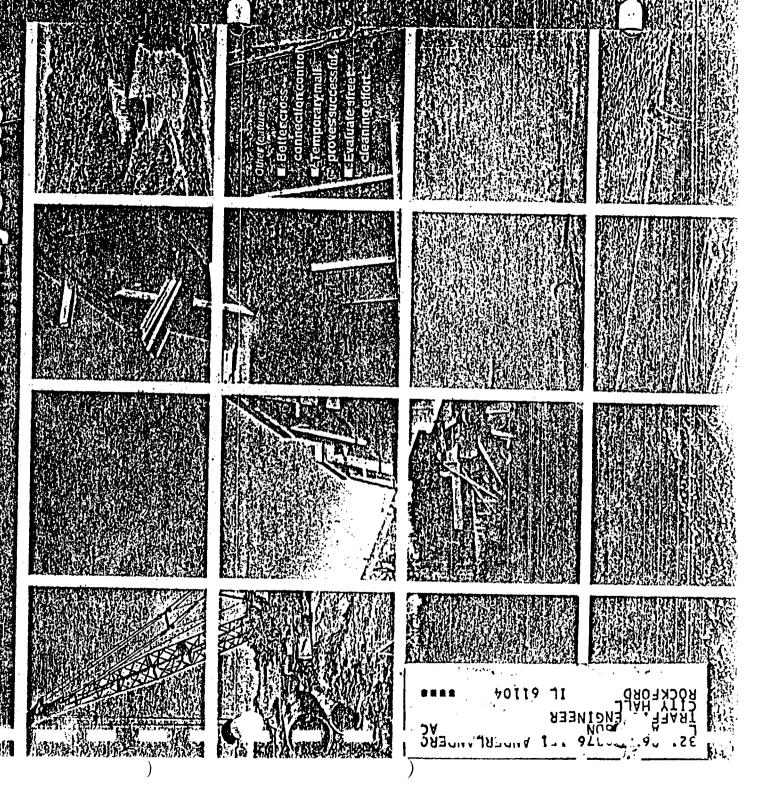
The new landfill has received a excellent rating by EPA inspetors. It is operated by a six-ma crew.

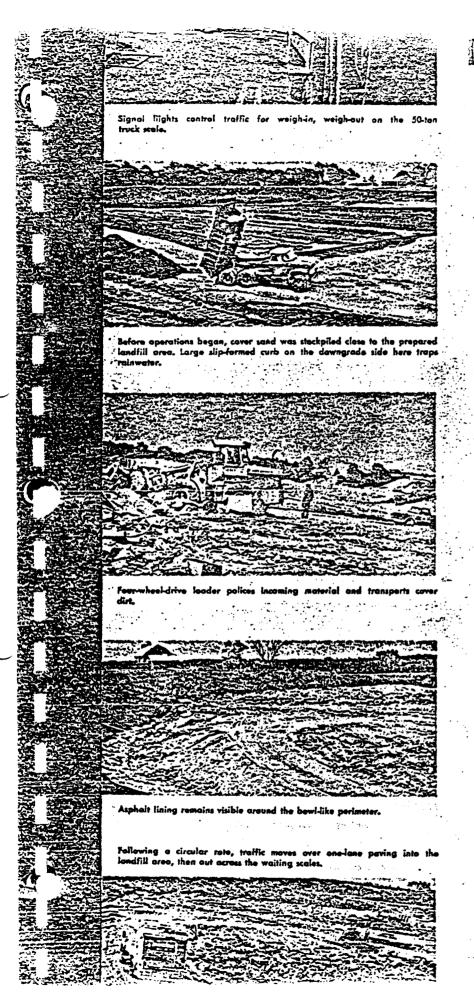
"We're happy to have this typ of solution," said former Publ Works Commissioner Cliffor Wendell. "There were very feplaces in our county geological suited for landfills. We had foun eight or 10 possible sites, but the were turned down either by zoring actions or socio-political presure."

The city should deliver about 50,000 tons of refuse a year to the site. An additional 75,000 tons we come from commercial and industrial sources.

Winnebago County has a moburning ordinance and the ciprovides, through contract, unlimited pickup of residential reuse. Under these conditions, the new landfill should reach is capacity of two million cu yowithin 10 to 12 years.

CHILD (a) GERTE CUIID.





Depleted Gravel Pi Adapted To Sanitary Landfil

After two years of planning and preparation, Rockfor Blacktop Co., Loves Park, Illinois, began receiving the fir truckloads of refuse at its new sanitary landfill site is southeast Winnebago County. The new landfill will serv the City of Rockford (population 145,000) and will accepted from private scavengers working throughout the county, which is centered in the state's top tier, borderin Wisconsin.

The site, originally a gravel pit, was depleted a decad ago, and is adjacent to a quarrying and crushing operation opened by Rockford Blacktop Co. in 1967. With the latest property acquisitions, the combined operation total about 65 acres.

Conceived and engineered by Bill Haward, Jr. of Rock ford Blacktop, the landfill meets requirements of the count zoning board and the Illinois Environmental Protection Agency. Construction and operation of the fill are under the direction of Charles Howard, brother of the engineer and co-awner with Bill Howard, Sr.

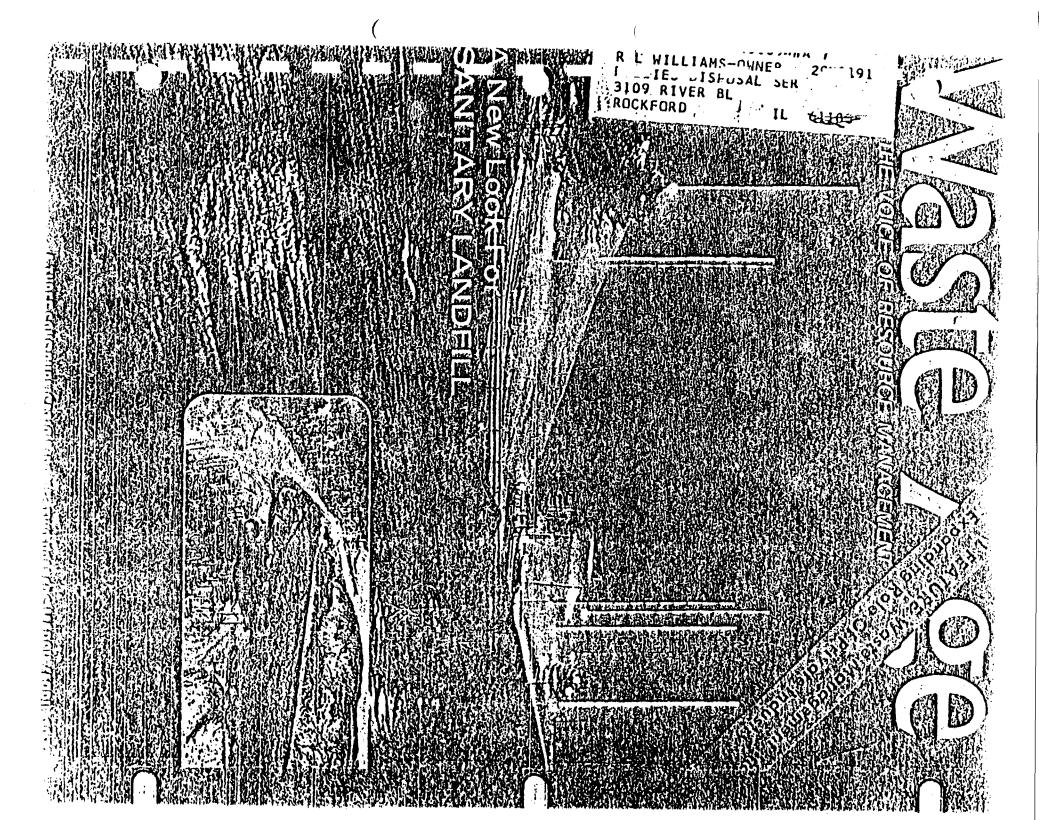
Conversion of the abandoned pit to a modern landfi required considerable investment in time, material and house and a 60-foot, 50-ton truck scale with electroni labor. Improvements and installations include a new scale head, 1½ miles of surfaced roads, 2 miles of 6-foot cyclon fence, and powered equipment. Floodlighting may be added if required.

A John Deere 15-cubic-yard scraper used on the rook construction will later be employed in placement of cover material. While cover is nearby, a JD644 rubber-tire loader will be used. Dumping is at present unrestricted; junked automobiles and large appliances being accepted. Compaction and refuse spreading will be handled by a 42-ton buildozer.

Much of this equipment was also used on construction of the landfill base itself, which serves to protect ground water. In the shape of a 90-degree circle segment, 10,000 square yards of two-inch asphalt are laid with a slipformer curb at the edge, and sealed with two coats of coal tar. Si inches of sand covers the asphalt, for protection agains incoming refuse and to act as drain. In operation, eac. 6-8 feet of compacted refuse compacted in 2-foot lifts wibe covered by a six-inch lift of sand. Rainfall or seepage i collected off the bottom, stored in a 20,000-gallon stee tank and recycled through the fill, if necessary because o quantity, by pumping back over the fill.

Dumping fee is \$5.95 per ton, with a 50 cent discount to large volume users. Estimated life of the fill is 10-13 years with no present plans for expansion.

The ultimate use of the landfill site has not been determined.



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To pave the extension of the bottom and side slopes Howard switched to an asphalt cold-mix prepared at a plant located in the rock quarry. The 2-inch lining is composed of crushed rock, sand and 6 to 6½ percent of a medium-setting cationic emulsified asphalt. The plant turns out approximately 130 tons of mix per hour. After again placing an asphalt dike along the inside edge of the paved area, workmen sealed the lining with one application of 0.25 gallon per square yard of the emulsified asphalt and two 0.25 gallon per square yard applications of tar emulsion. Bottom and side slopes then received 6 inches of sand. Two miles of 6-foot chain link fence have been erected, 1½ miles of road paved with asphalt concrete and a scale house built as a part of the project.

The landfill, now called the Winnebago County Land Reclamation Site, serves a population of about 200,000. Trucks dump from 500 to 600 tons of waste each day. Four monitoring wells are strategically located on the site so ground water can be checked for contamination.

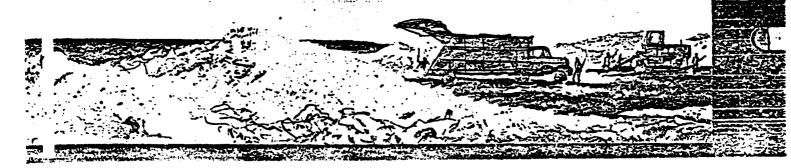
So successful is the landfill, the owner has received a letter from the Illinois Environmental Protection Agency lauding the project.

Line It and Put It To Use!

Abandoned Gravel Pit and Quarry in Illinois
Converted to Sanitary Landfill



BY A. D. HILL
District Engineer
The Asphalt Institute



Leachate—soluble constituents in combination with water comprising the material leached to the bottom lining.

2

£25

Winnebago Reclamation Service, Inc.

P.O. Box 2071 Loves Park, Illinois 61130 Office: 815/877-9561 Landfill: 815/874-7375

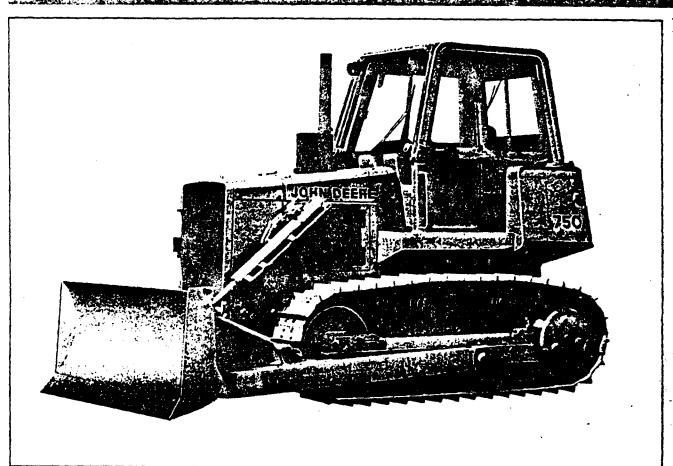
Cat D9 100,000 Lb. GVW 27" Track Width

Case 1450 31,400 Lb. GVW 20" Track Width

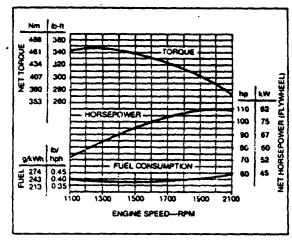


110,

750 NARROW-GAUGE BULLDOZER



ENGINE PERFORMANCE



FEATURES

110 SAE net hp (82 kW)

Dual-Path automatic hydrostatic drive with infinite speeds up to 6.5 mph (10.5 km/h)

Single lever for speed and direction control

Levers or pedals for independent track control steering

Heavy-duty double reduction planetary final drives

Automatically engaged parking brake

DURA-TRAX** sealed, desp-heat-treated track links and sealed, through-hardened

Single-lever dozer control w/hydraulic titt and blade float position

95.9-in. (2.44 m) blade width for ease of transport; 98.62-in. (2.50 m) blade width over standard end bits

Designed for quietness

Dual-stage aspirated dry-type air cleaner Roll-over protective structure (ROPS)

ADD VERSATILITY WITH:

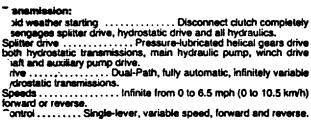
Freespool option
3- or 4-roller fairles

Swinging

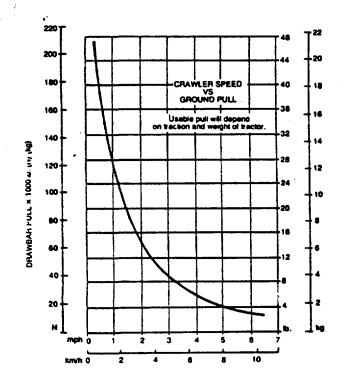
Ripper Parallelogram type with one to five shanks

soficiations and design subject to change without notice. Wherever applicable, specifications are in accordance with ICED and SAE Standards. Except where otherwise noted, the Sicatoris are based on a unit equipped with roll-over protective canopy, 18 in. (457 mm) grousers, full fuel tank, 175 lb. (79 kg) operator, and standard equipment.)

wer (@ 2100 rpm):	SAE	DIN
1 755	122 hp (91 kW) 110 hp (82 kW)	82 kW
angine power is with standard eq or and cooling ten. Gross power is ditions per SAEJ1349 and DIN 527 ude.	without cooling fan. Power ra	lings are at standard
Engine: John Deere 6-cylin 4 stroke cycle.	der turbocharged diese	ł, vatve-in-head,
re and stroke	414	cu. in. (6.785 L)
mpression ratio	m 345 lb-ft (468	Nm) (47.7 kg-m) 42
brication sin bearings	Pressure system	w/full flow filters7 notrolled bynass
Fan		Blower . Dry, dual stage
itteries (two 12 volt) cold o	ranking capacity at 0°F	
_	180 minutes each	or o ampo
anemission: old weather starting	Disconnect of	dutch completely



rawbar pull: at 0.30 mph (0.48 km/h)



-				
-	88	ø	~~	•

St	eering:		•
an	Ity modulated infinitely var d counterrotation. Pedal th cab. No need for steering	steering optional	with ROPS, standard
	akes:		
Pa Wi	rvice	et-disk brakes are	automatically applied
Hy	draulic System: Open-ci	enter	
	ontrol		
	imp		
Н	draulic Cylinders:	Bore	Stroke
Li	t, two	25 in. (108 mm)	31.85 in. (809 mm)
Ti C)	t, one 5. /linder rods Groun	5 in. (140 mm) d, heat-treated, ch	5.71 in. (145 mm) wome-plated, polished
sp an	acks: 6-roller track fram rocket guard, DURA-TRA id through-hardened seak nce.	X™ deep-heat-tre	ated sealed track links
G	Ouser		18 in. (457 mm)
Ţŗ	ack shoes, each side		40
G	round contact arearound pressure		90 SQ. M. (20 903 CM*)
9	country pressure	3.02 psi (02	Z NFE/ (V.OS NOTOTF)

B	ı	-	ď	c	ď

Digue.	
Cutting edge	3-piece
Center section	0.75 in. (19 mm)
End bits, boron steel	
Width over standard end bits	98.62 in. (2.50 m)
Width without end bits	95.9 in. (2.44 m)

 Length of track on ground
 90 in. (2.29 m)

 Track gauge
 64 in. (1.63 m)

 Oscillation
 10 in. (254 mm)

.... Hydraulic

Adjustment

Capacities: U.S.	Liters
Cooling system	26.5
Fuel tank	276.3
Crankcase	17
Crankcase, including filter	18.9
Splitter drive	5.7
Final drive, each: 1st reduction 5.375 gal.	20.3
2nd reduction	13.2
Hydraulic system	125
Hydrostatic drives	125

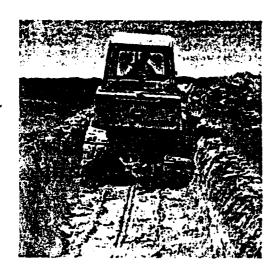
Additional Standard Equipment:

Alternator, enclosed, w/16-amp solid-state regulator
Air cleaner, dual-stage aspirated dry-type
Air cleaner restriction indicator
Bottom guards
Cigaret lighter Electric hourmeter Front idler shields Hinged grille guard Horn Key switch Lights, two front, one rear Master electrical disconnect switch Muttler, self-draining, eliminating external rain cap Pushbutton starting ROPS canopy w/seat belt Seat belt, 3 in. (76 mm) Suspension seat w/armrests Transmission neutral lock w/starter safety switch Toolbox Vandal protection Winch drive

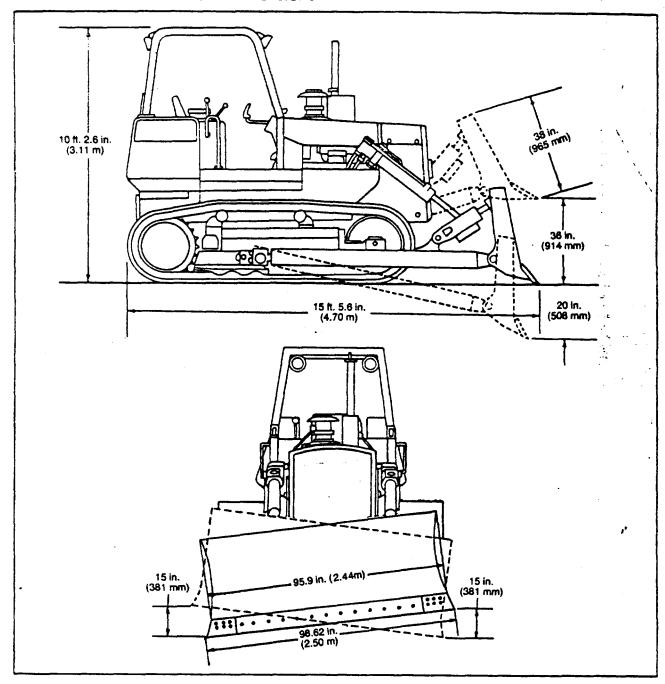
SAE Operating Weight w/ROPS 29,239 lb. (13 260 kg)

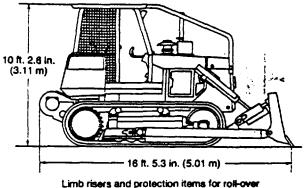
750 NARRO M-GAUGE BULLDOZER

Optional or Special Equipment with W	/elghts:	
(Add these weights to SAE Standard Eq	uioment	
operating weights to obtain total operating		
.,	lb.	kg
Batteries (two 12-volt) cold cranking		•
capacity @ 0°F (-18°C) 800 amps;		
reserve capacity 310 min. each	105	48
Cab with pressurizer, heater		
and 42-amp alternator	418	190
Air conditioner	109	49
Windshield washer	3	1
Cold weather starting aid	2	1
Cupped end bits	7	3
Drawbar, fixed	199	90
Engine coolant heater	2	1
Fan, reversible	30	14
Fire extinguisher	_6	.3
Front pull hook	33	15
Hydraulics:		_
Selector valve and lines to rear	14	6
Oil sampling test kit	2	1
Pedal extensions	7	3
Pedal steering	-12	-5
Protection items:		
Brush screens, heavy-duty	404	
third-post type	191	87
Brush screens, regular duty	72	33
Grille plate, hinged, heavy-duty	118 45	54
Guards, lift cylinder	494	20 224
Guards, upper tank Guards, final-drive seal	38	17
Limb risers	281	127
Perforated engine enclosures	121	55
Rear bumper, L.H., R.H. and center	870	395
Rear screen	50	23
Roof extension	475	215
Tank protection	588	267
Tilt cylinder hose protection	3	- 1
Radiator sand shield	25	11
Reverse warning alarm	10	5
Rock guard, center section	180	82
Tracks:		-
Dura-Trax™ lubricated		
chain w/18-in. (457 mm) grousers	0	0









Limb risers and protection items for roll-over protective structure

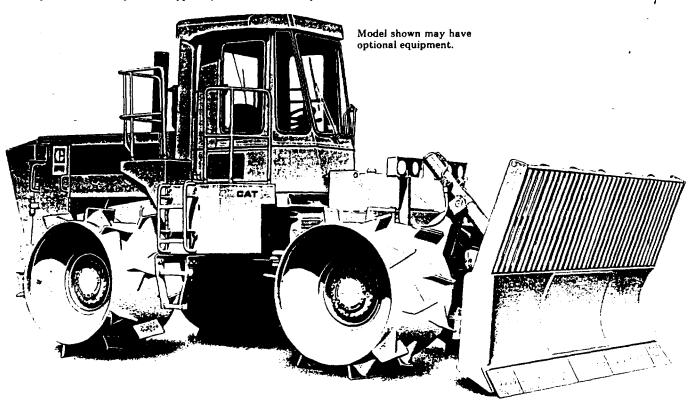


CATERPILLAR

816B Landfill Compactor

Summary of features

- Wheels chop and compact ... blades alternate in a staggeredchevron design for chopper coverage.
- Cat designed and manufactured power train ... for optimum match, performance and efficiency.
- Center-point articulation ... excellent maneuverability. Front and rear drums track, so material is chopped and compacted twice each pass.
- Protective guarding . . . helps keep trash from damaging machine components.
- Cat 3306 Engine . . . with 638 cu. in./10.5 liters displacement.
- Planetary power shift transmission lets the operator change directions at any speed. Four speeds forward, four reverse.
- Caterpillar landfill blade (optional) spreads refuse and cover material... strong enough to handle lumber, pipes and appliances.
- Operating ease and comfort... ROPS cab (standard in U.S.A.), excellent visibility, flow amplified steering, single-lever transmission control.
- CAT PLUS Services... from your Caterpillar Dealer... the most comprehensive, total product support system in the industry.



Caterpillar Engine

The net power at the flywheel of the vehicle engine operating under SAE standard ambient temperature and barometric conditions, 85° F/29° C and 29.38° Hg/995 mbar, using 35 API gravity fuel oil at 60° F/15.6° C, and after deductions for blower fan, air cleaner, water pump, lubricating oil pump, fuel pump, muffler, air compressor and alternator. Engine will maintain specified flywheel power up to 7500 ft./2300 m altitude.

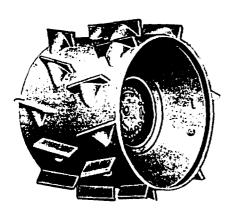
Caterpillar 4-stroke-cycle 3306 turbocharged diesel Engine, with six cylinders, 4.75''/121 mm bore, 6''/152 mm stroke and 638 cu. in./ 10.5 liters displacement.

Direct injection Caterpillar fuel system with individual adjustmentfree injection pumps and valves.

Stellite-faced valves, hard alloy steel valve seats, valve rotators. Cam-ground and tapered aluminum alloy pistons with 3-ring design, cooled by oil spray. Steel-backed aluminum bearings, thru-hardened crankshaft. Pressure lubrication with full-flow filtered and cooled oil. Dry-type air cleaner with primary and safety elements.

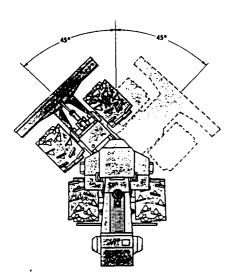
Uses No. 2 fuel oil (ASTM Specification D396), often called No. 2 furnace or burner oil, with a minimum cetane rating of 35. Premium quality diesel fuel can be used but is not required.

Two 24-volt direct electric starting systems — standard or low temperature.

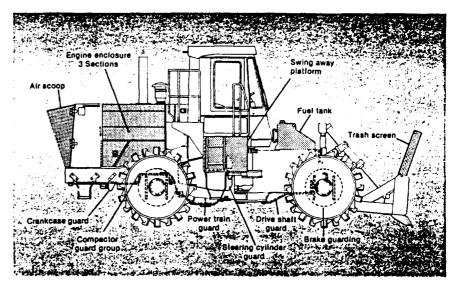


Chopper wheels are designed for sanitary landfill compaction and traction. Twenty chopper blades are welded to each drum in a staggered-chevron design that maximizes chopping action. They crush and chop trash in their path . . . from bottles and cans to water heaters and refrigerators. The blades are heat-treated, abrasion-resistant steel and rebuildable.

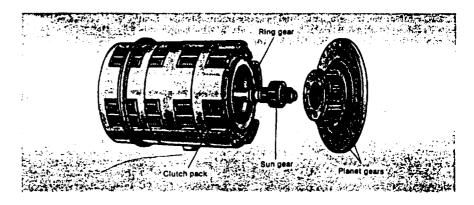
Planetary power shift transmission is designed for tough work . . . with big 13.6"/345 mm clutch packs. Hydraulic modulation cushions clutch engagement for full-power, on-the-go shifting. Planet gears spaced 120° apart spread out stresses for longer life. Oil cooling and lubrication reduce heat and wearing friction.



Center-point articulation and Caterpillar stable 4-drum design give the 816B greater maneuverability than 3-wheel or double-drum compactors. And the compaction coverage is doubled, since front and rear drums track even through turns. Rear axle oscillation of $\pm 8^\circ$ helps keep the drums on the ground for traction and stability.



Rugged guarding helps protect against landfill hazards. Engine and power train guards shield these components from damage by rock, metal fragments or corrosive chemicals... and helps prevent trash from entering the engine compartment from below. Perforated hood and engine enclosures, and air scoop reduce trash accumulation and radiator clogging. Inner wheel guards protect the brakes. Steering cylinder and hydraulic tank guards helps keep these areas from being punctured. Fuel tank is on top of front frame... away from refuse.





Sound-suppressed cab plus ROPS contains many standard operator comfort features. ROPS structure is isolated from operator's station which enables the cab to be resiliently mounted to the vehicle chassis. When properly installed and maintained cab meets OSHA and MSHA requirements for operator sound exposure limits in effect at date of manufacture. Cab features include tinted glass, windshield washer/wiper, dome lights, pressurized and filtered air circulation system, inside mounted rear view mirrors, coat hook, cigar lighter, ash tray, floor mat and lockable entry door — all standard. Cat air conditioner and heater are optional.

Landfill Compactor



transmission

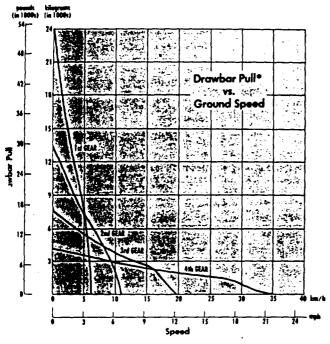
Planetary type. Full power shift in four forward and four

Single lever on left side of steering column controls both speed and direction. Rotate the handle for four speeds in each direction. Move the lever forward or backward for directional change. Separate lever locks the transmission control in neutral.

Single-stage, single-phase torque converter.

Speeds:

1st	2nd	3rd	4th
Forward, MPH: 3.9	7.0	12.4	22.0
km/h: 6.3	11.2	19.9	35.3
Reverse, MPH: 4.5	8.0	14.1	25.1
km/h: 7.2	12.9	22.8	40.4



^{*}Actual travel speed and usable pull will depend on weight and traction of equipped tractor



Front axle fixed, rear axle oscillates ±8°, total of 16°. One wheel can drop or rise a total of 12.7"/323 mm with all wheels remaining on ground for maximum traction. Conventional differentials.



final drives

All-wheel drive with planetary reduction in each wheel.

frame

Two frames fabricated from steel plate and rolled sections. Joined at the center by two hardened-steel pins. Straight upper roller bearing and double-tapered lower roller bearing, with 1000 hour lube intervals on both.



steering

Flow amplified steering with articulated frame gives precise control for maneuvering in tight quarters.

Minimum turning radius
(outside corner of blade)
Clearance circle with blade
Steering angle (each direction) 45°
Hydraulic system - two 4"/102 mm bore, double-acting cylinders
powered by vane-type pump:
Output @ 2090 RPM with
1000 psi/69 bar/6895 kPa
Relief valve setting



brakes

Service - four-wheel, air over hydraulic wedge actuated, automatically adjusted shoe brakes.

Parking - uses drive line, drum-type shoe brake, spring applied, air released.

service refill capacities

	U.S. Gallons	Liters
Fuel tank	. 122	462
Cooling system	. 12	44
Crankcase	. 7.7	29
Transmission and torque converter	15.9	60
Differential and final drives:		
Front	. 13.7	52
Rear	. 13.5	51
Hydraulic system	. 35	134



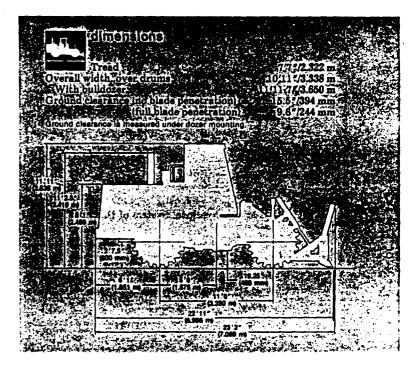
operating weight (approximate)

Includes lubricants, coolant, operator, full fuel tank, bulldozer, ROPS cab and hydraulic system. .45,477 lb./ 20628 kg

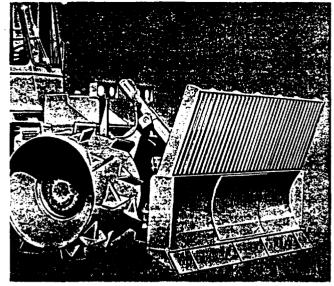


wheels

Drum width Diameter, over blades	.40"/1016 mm
Diameter, over blades	.63"/1600 mm
Over drum	51.2"/1300 mm
Total blades per wheel	20
Blade length	.13.7"/348 mm
Blade height	
Blade thickness	87"/22 mm







Cat landfill bulldozer blade . . . designed to spread both refuse and cover material . . . tough enough to handle lumber, pipe, appliances.

The moldboard is heat-treated and backed by multiple box-sections for the strength needed to move big loads. Curved moldboard design keeps cover material rolling evenly. Trash screen has solid 1"/25 mm steel base for additional strength to withstand high impact encountered when dozing refuse. Balderson landfill U-blade is available through your Caterpillar dealer.

standard equipment

35-amp alternator. Lockable toolbox. Drawbar hitch. 24-volt direct electric starting. Fuel priming pump. Muffler. Seat

belt. Front warning horn. Back up alarm. Cab. ROPS, sound suppressed with air pressurization. Decelerator. Suspension seat. Landfill guard group.

bulldozer

Complete unit consists of blade, push arms, trunnion mounting, reversible cutting edges, self-sharpening end bits, hydraulic lift cylinder, hydraulic lines guard and control valve.

Blade:

Length	11'11.7"/3.650 mm
Height to top of trash screen	6'3"/1.915 m
Ground clearance, maximum	36.3"/921 mm
Depth of cut, maximum	
Moldboard material	Heat-treated steel
Construction	

Cutting edges (reversible):

Length, center section	29.83"/758 mm
Length, each end section	40.5"/1029 mm
Width x thickness	75" x 10"/19 x 254 mm
Material	h-hardened DH-2 steel

End bits (self-sharpening):

Length, each		16"/409 mm
Width x thickness		254 x 25 mm
Material	Through-hardened	DH-2 steel

Hydraulic system:

One control lever for raise and lower. Hydraulic oil is full-flow filtered.

Pump output @ 2090 RPM and

1000 psi/69 bar/6895 kPa with

SAE No. 10 oil @ 150°F/66° C34 gpn	n/129 liters/min
Relief valve opening pressure	
Cylinder, double acting,	

bore x stroke 4.75" x 36.5"/121 x 928 mm

optional equipment

•	Lb	Kg
Air conditioner	78.8	36
Air scoop	420	191
Alternator, 50-amp	15	7
Bulldozer, landfill	3,000	1270
Cab deletion	-511	-232
Canopy, ROPS, deletion	-1.600	-750
Differential, NoSPIN (rear axle only)	5	2.3
Fast fuel adapter	17	7.7
Fire extinguisher	35	16
Gauge package	4	2
Hand throttle/decelerator	15	7
Heaters:		
Heater/defroster (cab)	10	4.5
Engine coolant (110 volt)	3	1.3

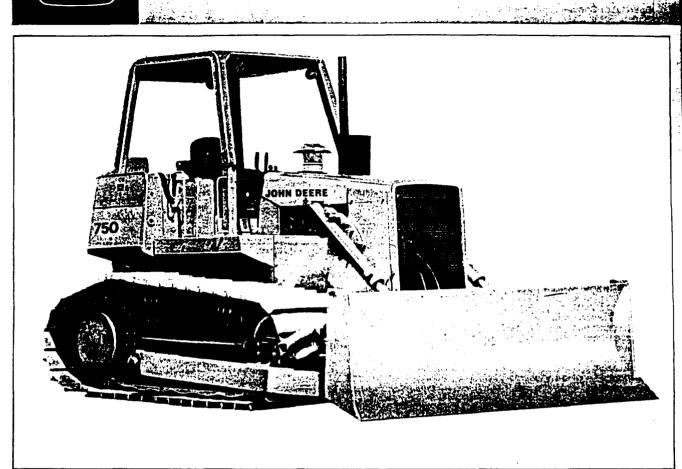
Lighting system, 2 working lights	Lb 8	Kg 3.6
Ether	6	2.7
Heavy duty batteries	50	23
Seat cover (fabric)	2	1
Striker bar	400	181
Tool kit	20	9
Vandalism protection: Instrument panel guard (without cab) Cap locks for fuel tank, hydraulic	3	1
tank, and radiator Wiper/washer, rear window	11 4	5 2

Materials and specifications are subject to change without notice.

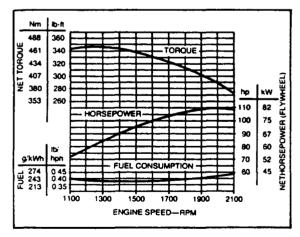


#1131

750 WIDE-TRACK BULLDOZER



ENGINE PERFORMANCE



Note: The 750 Wide-Track Bulldozer is designed to work in mud, snow or other soft ground conditions. Frequent misapplication in rocky or hard ground will decrease undercarriage life and may cause component damage.

FEATURES

110 SAE net hp (82 kW)

Dual-Path automatic hydrostatic drive with infinite speeds up to 6.5 mph (10.5 km/h)

Single lever for speed and direction control

Levers or pedals for independent track control steering

Counterrotating tracks

No steering clutches or steering brakes

Automatically engaged parking brake

DURA-TRAX™ deep-heat-treated sealed track links and through-hardened sealed rollers

34-in. (864 mm) track shoes for flotation

Single-lever dozer control w/hydraulic tilt and blade float position

Dual-stage aspirated dry-type air cleaner

Designed for quietness

Roll-over protective structure (ROPS)

ADD VERSATILITY WITH

Winch

Regular or slow-speed gearing Free spool option 3-or 4-roller fairlead

Drawbar Rigid Swinging

750 WICE-TRACK BULLDOZER SPECIFICATIONS

(Specifications and design subject to change without notice. Wherever applicable, specifications are in accordance with ICED and SAE Standards. Except where otherwise noted, these specifications are based on a unit equipped with rollover protective canopy, full fuel tank, 175 lb. (79 kg) operator, and standard equipment.)

*ower (@ 2100 rpm):	SAE	DIR	
)\$\$. 122 hp (91 kW)		
at	. 110 hp (82 kW)	82 kW	
Net engine namer is with standard envisors	at including air cleaner	avhauet evelom	a

Net engine power is with standard equipment including air cleaner, exhaust system, alter-nator and cooling fan. Gross power is without cooling fan. Power ratings are at standard conditions per SAEJ1349 and DIN 6270. No derating is required up to 10,000 feet (3050 m)

Engine: John Deere 6-cylinder turbocharged diesel, valve-in-head, 4 stroke cycle. 3ore and stroke 4.19×5 in. (106.4×127 mm) Lubrication

Main bearings

Cooling

Pressurized w/thermostat and controlled bypass

Fan

Blower

Air cleaner w/restriction indicator

Dry, dual stage

Electrical system

24 volt w/alternator

Batteries (two 12 volt) cold cranking capacity at 0°F

-18°F)

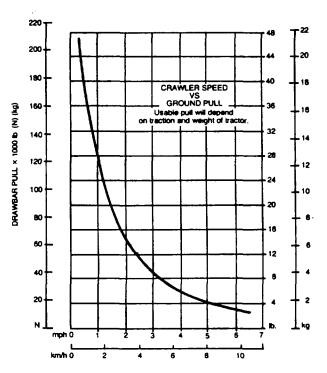
570 amps Reserve capacity: 180 minutes each

Transmission:

Cold weather starting Disconnect clutch completely disengages splitter drive, hydrostatic drive and all hydraulics. Splitter drive Pressure-lubricated helical gears drive both hydrostatic transmissions, main hydraulic pump, winch drive shaft and auxiliary pump drive. Drive!..... Dual-path, fully automatic, infinitely variable hydrostatic transmissions. Speeds Infinite from 0 to 6.5 mph (0 to 10.5 km/h) forward or reverse. Control Single-lever, variable speed, forward and reverse.

Drawbar pull:

Maximum drawbar pull 47,500 lb. (211 kN) (21 550 kg) at 0.30 mph (0.48 km/h)



Fully modulated infinitely variable lever steering for live power turns

and counterrotation. Peda clutches or steering brakes		to need for steering
Brakes: Service Parking when engine is stopped, of during normal operation.	Wet-disk brakes are a	automatically applied
Hydraulic System: Open- Control	Single-lever	two-function control rated engine speed kPa) (140.6 kg/cm²)
Hydraulic Cylinders:	Bore	Stroke
Lift, two	4.25 in. (108 mm) 5.5 in. (140 mm) and, heat-treated, chro	31.85 in. (809 mm) 5.71 in. (145 mm) ome-plated, polished
Tracks: 6-roller track fra sprocket guard. DURA-TR and through-hardened seatance.	AX** deep-heat-treat	ed sealed track links
Grouser		34 in. (864 mm)
Track shoes, each side		40
Ground contact area Ground pressure	5 1 psi (35 2	/ sq. in. (39 464 cm²) · kPa) (0 358 ko/cm²)
Length of track on ground Track gauge Oscillation		90 in. (2.29 m)
Track gauge	• • • • • • • • • • • • • • • • • • •	74 in. (1.88 m)
Carrier rollers	• • • • • • • • • • • • • • • • • • • •	10 In. (254 mm)
Adjustment		
Minimum ground clearance	B	14 in. (356 mm)
Blade:		
Cutting edge		3-piece
Center section	****************	0.75 in. (19 mm)

Cutting edge			
Center section			
End bits, boron ste	əl	 	. 0.75 in. (19 mm)

Capacities:	U.S.	Litera
Cooling system	7 gal.	26.5
Fuel tank		276.3
Crankcase	18 qt.	17
Crankcase, including filter	20 at.	18.9
Splitter drive	1.5 gal.	5.7
Final drive, each: 1st reduction	8.5 gal.	32.2
2nd reduction		17
Hydraulic system	33 gal.	125
Hydrostatic drives	33 gal.	125

Additional Standard Equipment:

Alternator, enclosed w/16-amp solid-state regulator Air cleaner, dual-stage aspirated dry-type

Air cleaner restriction indicator

Bottom guards Cigaret lighter Electric hourmeter

Front idler shields Hinged grille guard

Horn Key switch

Lights, two front, one rear Master electrical disconnect switch

Muffler, self-draining, eliminating external rain cap

Pushbutton starting

ROPS canopy w/seat belt

Suspension seat w/armrests

Transmission neutral lock w/starter safety switch

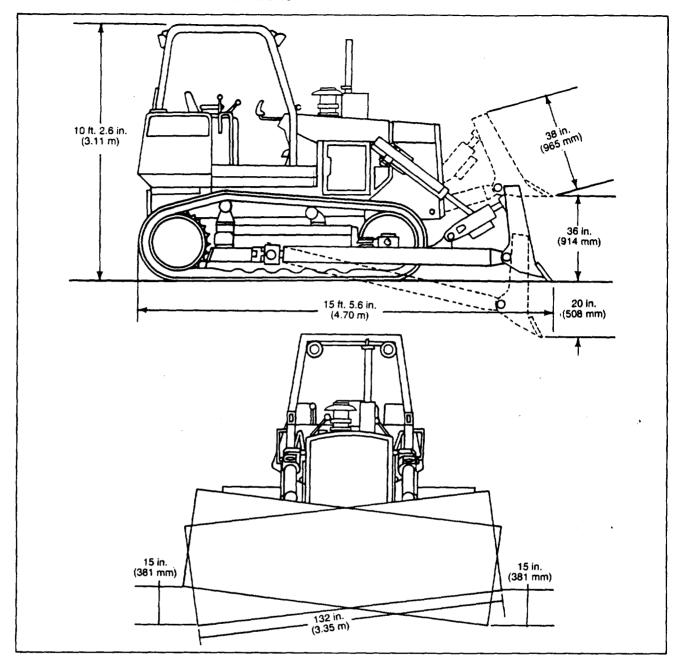
Toolbox

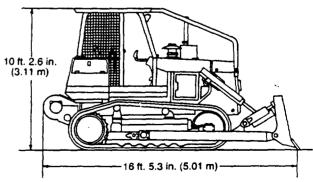
Vandal protection

Winch drive

SAE Operating Weight w/ROPS 31,375 lb. (14 230 kg)

750 WIDE-TRACK BULLDOZER DIMENSIONS





Limb risers and brush-protection assembly for roll-over protective structure

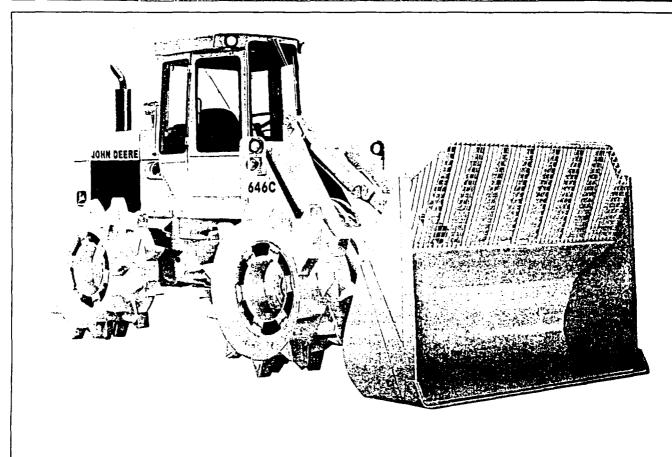
750 WIDE-TRACK BULLDOZER

Ontional	٥r	Special	Equipment	with	Weighte:
ODUGINAL	U	Special	Ednibilielii	AA I I I I	Weights.

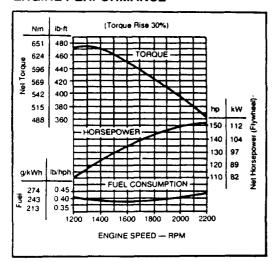
optional of opecial Equipment with the	giita.	
(Add these weights to SAE Standard Equ		
operating weights to obtain total operating	y weights.) lb.	kg
Batteries (two 12-volt) cold cranking capa		~9
@ 0°F (-18°C) 800 amps;	•,	
reserve capacity 310 min. each	105	48
Cab with pressurizer, heater		
and 42-amp alternator	418	190
Air conditioner	109	49
Windshield washer	3	1
Cold weather starting aid	2 7	1 3
Cupped end bits	199	90
Drawbar, fixed Engine coolant heater	2	1
Fire extinguisher	6	3
Front pull hook	33	15
Hydraulics:	55	,,,
Hydraulic lines to rear	4	2
Hydraulic valve, third function	10	5
Selector valve and lines to rear	14	2 5 6 1 3 -5
Oil sampling test kit	2	1
Pedal extensions	7	3
Pedal steering	12	-5
Protection items:		
Brush screen, heavy-duty	404	
third-post type	191	87
Brush screens, regular duty Grille plate, heavy-duty	72 118	33 54
Guards, bottom, heavy-duty	280	127
Guards, lift cylinder	45	20
Guards, final-drive seal	38	17
Limb risers	281	127
Perforated engine enclosures	121	55
Rear screen	50	23
Roof extension	475	215
_ Tank protection	588	267
Radiator sand shield	25	11
Reverse warning alarm	10	5
Rock guard, center section	180	82
Tracks:		
Dura-Trax™ lubricated chain w/		
split master link 23-in. (864 mm) single bar grousers	0	0
anigia uai givusais	U	v



646C COMPACTOR



ENGINE PERFORMANCE



Fuel consumption rate based on maximum horsepower at each nel torque requirement. Depending on operation variables, a typical duty cycle averages about sixty percent of maximum fuel usage.

FEATURES

Vandal protection

152 SAE net hp (113 kW) Protective guards: 4-wheel drive **Bottom** Choice of 3 landfill buckets Hydraulic lines Torque converter w/Power Shift Engine Transmission Power steering, articulated frame Articulation 4-wheel, wet-disk brakes and parking Radiator Inboard planetary final drives Front drive line Automatic return to dig Front and rear work lights NoSPIN front axle differential Side shields

Axle seal

Roll-over protective structure (ROPS) w/cab and tinted safety glass. Meets criteria of SAE J394, SAE J1040A, and ISO 3471. Also meets FOPS (falling object protective structure) criteria SAE J231 and ISO 3449.

64CC COMPACTOR SPECIFICATIONS

(Specifications and design subject to change without notice. Wherever applicable, specifications are in accordance with ICED and SAE Standards. Except where otherwise noted, these specifications are based on a unit equipped with refuse bucket, standard equipment, full fuel tank, and 175-lb. (79 kg) operator.)

	0.4=	DIM	0005 1440 000 1 5 -> 4404 0	1 - 1 25 - 12 - 1
Power (@ 2200 engine rpm): Gross	SAE . 167 hp (125 kW) 152 hp (113 kW) 154	DIN hp (113 kW)	ControlTwo	kg/cm²) relief-valve pressure setting. lever triple hydraulic valve for use with Single lever with refuse bucket.
				Engine-driven, 8-piston,
Net engine flywheel power is for an engine lubricating oil pump, fuel pump, alternat without fan. Flywheel power ratings are un	tor, and muffler. The gross ider SAE standard conditions of the c	engine power is of 500-ft. (150 m)	gine rpm and 2000 psi (13.75 tem pressure is 2400 psi (16.	delivers 28.5 gpm (1.8 L/s) at 1800 en- 30 kPa) (140.6 kg/cm²). Maximum sys- 548 kPa) (168.7 kg/cm²).
attitude and 85° (29.5°C) temperature, and derating is required up to 10,000 ft. (3050)	nd DIN 70 020 conditions (no m) altitude.	n-conecteu). No		•
*		and vertical	Landfill Buckets	Capacity Width
Engine: John Deere turbocharg 6-cylinder, valve-in-head, 4-strok Bore and stroke	ke cycle.		Refuse Dir	(2.10 m ³) (2.81 m)
Piston displacement	466 cu.	. in. (7.636 L)		(3.44 m ⁵)
Maximum torque @ 1300 rpm . NACC or AMA (U.S. Tax) horsen	472 lb-ft (640 Nm) (65.2 kg-m)	Light materials	(3.44 m ³) (2.81 m)
Lubrication Pressurized	Pressure system w/	full-flow filter	Multipurpose Dir	(1.91 m ³) (2.66 m)
Fan		Suction	Refuse	e: 3¾ cu. yd. (2.87 m³)
Electrical system	12-vol	t w/alternator	Compactor Wheels:	
Batteries (three 12 volt) 25	Danasia aastalkii 470:		•	
amp at 80° F (27°C) F Alternator		minutes each	Diameter over cleats	60 in. (1524 mm)
BCI group 31 cold cranking capa at 0°F (-18°C)	acity	625 amos	10 contour deats/wheel (le	ngth at tip) 5.5 in. (140 mm) ngth at tip)
, ,			Compaction Up to Weight per linear inch of dr	o 3830 psi (26 408 kPa) (269.2 kg/cm²) rum width
Torque Converter: Type		Twin-turbine	Rubber damper assemblie:	s/wheel6
Torque multiplication		3.19 to 1	Wheel Treads and Width:	
Transmission	Power S	hift planetary		ter)
Differentials:			Capacities:	U.S. Liters
Front			Cooling system	
Drive Axles:			Crankcase	
Inboard-mounted planetary gear Rear axle oscillates 22-degree travel at center of wheel. Rear a	total, 15.8 inches (401	mm) vertical	Transmission case and filters Front differential: NoSPIN	
Recommended Travel Speeds		(4.55).	Rear differential Loader hydraulic sump	
Forward	4.5 mph (7.2 km	/h) maximum	Additional Standard Equipr	nent:
Reverse *Adjusted for rolling resistance of			Adjustable cushioned seat	Hand grips
trash	,	•	Antifreeze Automatic boom height contro	Horn on Key switch
Brakes:			Automatic return-to-dig	Lights
	4-wheel, inboard-mour	nted wet disk.	Cigaret lighter	Loader hydraulic system indicator
Service Power actuated,			Electric hourmeter	Muffler
Foot-operated by either right or I	left pedal.		Engine side shields	NoSPIN front-axle differential
Foot-operated by either right or I Parking 10x3-in. (254)	left pedal. 4x76 mm) expanding s	hoe on trans-	Engine side shields Ether starting aid Fire extinguisher	NoSPIN front-axle differential Parking brake warning light Precleaner
Foot-operated by either right or I Parking 10x3-in. (254 mission output shaft. Foot open	left pedal. 4x76 mm) expanding s	hoe on trans-	Engine side shields Ether starting aid Fire extinguisher Fixed drawbar Front and rear windshield wip	NoSPIN front-axle differential Parking brake warning light Precleaner Pushbutton safety start ters Radiator guard and screen
Foot-operated by either right or I Parking	left pedal. 4x76 mm) expanding s trated, with warning lig	hoe on trans- ght on instru-	Engine side shields Ether starting aid Fire extinguisher Fixed drawbar Front and rear windshield wip Fuel filter	NoSPIN front-axle differential Parking brake warning light Precleaner Pushbutton safety start Pers Radiator guard and screen Reverse warning alarm
Foot-operated by either right or I Parking	left pedal. 4x76 mm) expanding s trated, with warning lig culated 80 degrees by 1. 7 in. (5.05 m).	hoe on trans- ght on instru-	Engine side shields Ether starting aid Fire extinguisher Fixed drawbar Front and rear windshield wip Fuel filter Gauges: Oil and temperature Fuel	NoSPIN front-axle differential Parking brake warning light Precleaner Pushbutton safety start Radiator guard and screen Reverse warning alarm ROPS cab w/heater/defroster and pressurizer Seat belt
Foot-operated by either right or 1 Parking	left pedal. 4x76 mm) expanding s trated, with warning lig culated 80 degrees by t. 7 in. (5.05 m). in. (11.70 m).	hoe on trans- pht on instru- two hydraulic	Engine side shields Ether starting aid Fire extinguisher Fixed drawbar Front and rear windshield wip Fuel filter Gauges: Oil and temperature Fuel Engine oil pressure Voltmeter	NoSPIN front-axle differential Parking brake warning light Precleaner Pushbutton safety start ers Radiator guard and screen Reverse warning alarm ROPS cab w/heater/defroster and pressurizer Seat belt Three-spool valve Toolbox
Foot-operated by either right or 1 Parking	left pedal. 4x76 mm) expanding s trated, with warning lig culated 80 degrees by t. 7 in. (5.05 m). in. (11.70 m).	two hydraulic in. (438 mm) n. (95.25 mm)	Engine side shields Ether starting aid Fire extinguisher Fixed drawbar Front and rear windshield wip Fuel filter Gauges: Oil and temperature Fuel Engine oil pressure	NoSPIN front-axle differential Parking brake warning light Precleaner Pushbutton safety start Radiator guard and screen Reverse warning alarm ROPS cab w/heater/defroster and pressurizer Seat belt Three-spool valve Toolbox Transmission disconnect windshield washer
Foot-operated by either right or 1 Parking	left pedal. 4x76 mm) expanding s trated, with warning lig culated 80 degrees by t. 7 in. (5.05 m). in. (11.70 m).	two hydraulic in. (438 mm) n. (95.25 mm)	Engine side shields Ether starting aid Fire extinguisher Fixed drawbar Front and rear windshield wip Fuel filter Gauges: Oil and temperature Fuel Engine oil pressure Voltmeter Coolant temperature	NoSPIN front-axle differential Parking brake warning light Precleaner Pushbutton safety start lers Radiator guard and screen Reverse warning alarm ROPS cab wheater/defroster and pressurizer Seat belt Three-spool valve Toolbox Transmission disconnect

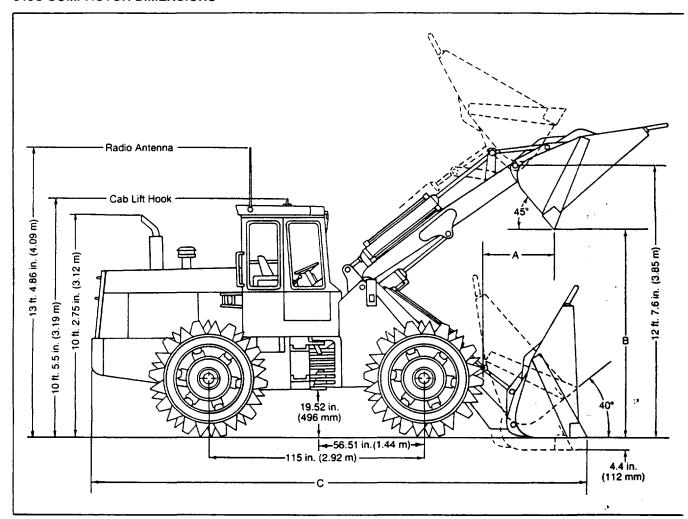
Special Equipment:

Special Equipment:

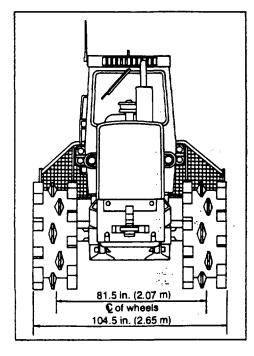
Adjustable suspension seat, vinyl or cloth covered Air conditioner

Engine coolant heater
Light-materials bucket
Multipurpose bucket teeth
Multipurpose landfill bucket
Rear-view mirror
Refuse bucket
3-inch (76 mm) seat belt

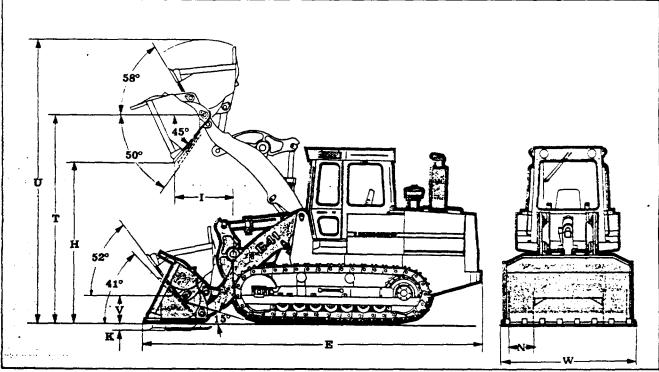
646C COMPACTOR DIMENSIONS



	DIMENSIONS				
BUCKET CAPACITIES	A	В	С		
4½ cu. yd. (3.44 m³) Refuse	33.5 in.	9 ft. 11.3 in	22 ft. 3.4 in.		
	(851 mm)	(3.03 m)	(6.79 m)		
3¼ cu. yd. (2.87 m³)	34.60 in.	9 ft. 3.9 in.	23 ft. 1.5 in.		
MultiPurpose	(879 mm)	(2.84 m)	(7.05 m)		
4½ cu. yd. (3.44 m³)	42.27 in.	9 ft. 2.53 in.	23 ft, 3.8 in.		
Light Material	(1074 mm)	(2.81 m)	(7.11 m)		



Standard Bucket

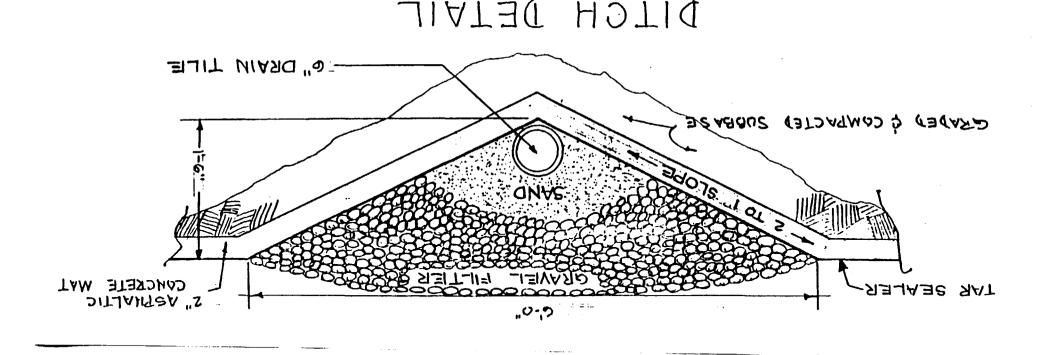


Capacity SAE heaped Breakout-force Static tipping load	3.8 cu.yd./2.9 m ³ 45,200 lbs/201 kN (20,500 kg) 41,200 lbs/18,690 kg
Dimensions E Overall length H Dumping height at 45° I Reach at 45° K Max. digging depth below grade U Overall height T Max. height of hinge pin V Height of hinge pin with maximum bucket tilt W Width of bucket	ft-in/mm 22' 8"/6910 10' 6"/3200 4' 2"/1270 5"/ 125 18' 7"/5675 13' 9"/4180 1'10"/ 555 9' 0"/2750
Operating Weights Basic machine with standard bucket and triple-grouser trackpads 18"/457 mm double-grouser trackpads 20"/508 mm double-grouser trackpads 22"/560 mm double-grouser trackpads 26"/660 mm	1bs/kg 53,900/24,450 53,900/24,450 54,300/24,620 55,000/24,950
Ground Pressures Basic machine with standard bucket and triple-grouser trackpads 18"/457 mm double-grouser trackpads 20"/508 mm double-grouser trackpads 22"/560 mm double-grouser trackpads 26"/660 mm	PSI/kg/cm ² 12.94/0.91 11.66/0.82 10.66/0.75 9.24/0.65
Required Components • Loader linkage • Standard bucket	Part-No. 9034 883 9034 767

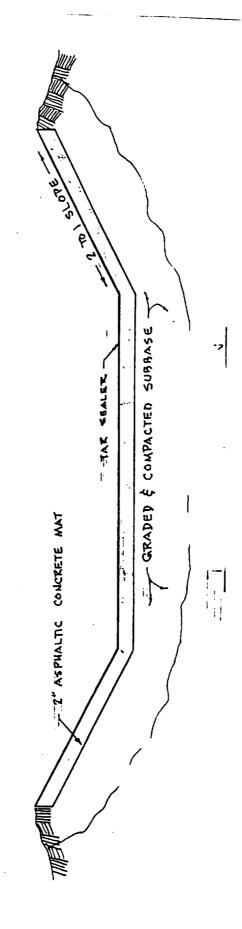


11869
8° MAND AND PIPE
6"PERFORATED PIPE
2" MATHET MAT
EARTH

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2CVIE: HOHE



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NOVEMBER 27 **UPDATE**

PAGE: 007

DETAIL FOLIO NO 0791903SS

HEADER FOLIO NO

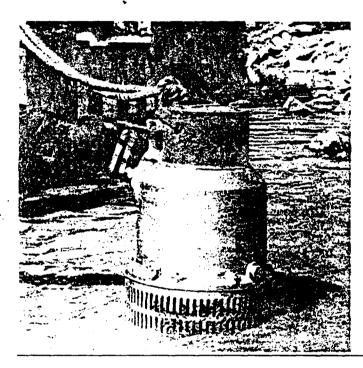
WINNEBAGO RECLAMATION SERVICE ATTN: JOHN LICHTY 4920 FOREST HILLS ROAD ROCKFORD 61111

005 3188 TSS 284 DATE PAGE NO LBS 42,800 \$ 43,220 \$ 48,340 \$ 11-02-87 17457 17458 17459 11-02-87 ī ī - ŏ ī - ĕ 7 44,000 43,960 11-02-87 17460 11-02-87 17461 # 17462 11-03-87 44 + 120 * 11-03-87 44,140 17463 11-04-87 17464 17465 44,600 45,580 45,260 44,280 47,000 * 11-04-87 17466 11-04-87 17467 17468 11-05-87 17469 * 11-05-87 17470 43+340 # 11-09-87 17001 45,040 45 . 880 11-09-87 ± 17471 11-09-87 43,900 44,440 17472 * 11-09-87 17473 44,160 44,200 44,260 44,420 44,120 46,580 11-09-87 17474 # 11-09-87 # 11-10-87 17002 11-10-87 17003 17004 * 11-10-87 ÷ 11-10-87 17005 45.140 45.500 11-10-87 11-12-87 17006 # * 11-12-87 11-12-87 11-13-87 44,340 45,400 44,800 17008 17009 17010 * # * 11-13-87 48,040 17011 * 11-13-87 11-13-87 44,960 17012 * 17013 17014 17015 11-13-87 44,680 * 45 • 260 42 • 940 11-13-87 **‡** 11-13-87 17016 44.980 43.480 11-16-87 11-16-87 17017 17018 * 11-16-87 17019 43,460 幸 11-16-87 44,620 17020 44,860 43,880 17021 11-16-87 17022 ≄ 11-16-87 11-17-87 17023 17024 46,400 * 41,980 44,240 44,760 43,340 11-17-87 17025 ቋ 17077 17078 11-17-87 11-18-87 * 43,520 46,300 45,200 11-18-87 17079 盘 11-18-87 11-18-87 17080 17081 11-18-87 17082 44,300 立 11-18-87 11-23-87 44,960 17083 44,640 44,800 17084 11-23-87 11-23-87 11-23-87 17085 ٠ 45,200 45,100 17086 # 17087 45,920 47,200 47,860 11-24-87 17088 # 11-24-87 17089 **‡** 17090 11-24-87 11-25-87 17091 44,420 * 17092 # 44.260 45.260 11-25-87 17093 11-30-87 17094 ± 11-30-87 17095 44,420 ***** RUN DATE: 12/05/87 PROGRAM : SHDTMNTH SANITARY DISTRICT OF ROCKFORD SEPTIC HAULER'S MONTHLY REPORT NOVEMBER 87 UPDATE PAGE: 008 DETAIL FOLIO NO 0791903SS HEADER FOLIO NO 11-30-87 11-30-87 11-30-87 11-30-87 17096 17097 44,460 **≠** 46,560 **≠** 42,660 **≠** 17098 17099 17100 46,600 ≠ 11-30-87 39,140 ≠ TOTAL LBS- 3,043,680 / 6305.146 = TOTAL CCF TOTAL LBS BILLED- 6,087,360 / 6305.146 = TOTAL CCF 3ILLED 483 965 TOTAL LOADS-68 CHARGE FOR LABWORK

FLOW DOUBLED FOR BILLING PURPOSES ONLY AS PER ORDINANCE NO. 483.



Small portable dewatering pump



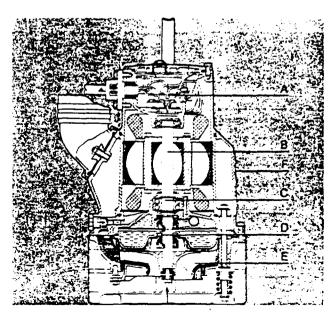
Compact one-man pump has low power consumption

- 4.5 HP single phase (230 V) motor
 6.0 HP three phase (230/460 or 575 V) motor.
- High heads to 125 ft.
- Up to 450 U.S. GPM capacity.

Applications: The BS 2095 is ideal for fast dewatering of deep holes, trenches, ditches, excavations etc.

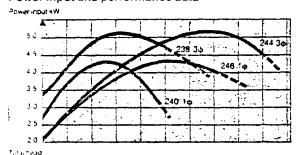
Design features

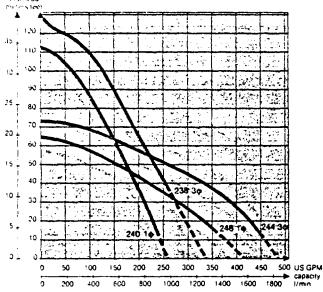
- A Junction chamber. In the cable entry water sealing is functionally separated from strain relief, no epoxy, grommet's controlled compression (no over- or under-tightening) assures leakproof sealing. Beyond the cable entry, the terminal board provides a secondary seal protecting the motor housing. Terminal board connections easily changed to suit various service voltages.
- B Motor, Non-overloading for full performance range. Runs in air, safer, more efficient, and easier to service than oil-filled motors. Stator+Class F winding rated to 310°F (155°C), shrink-fit: improves cooling, no leakage, no outside retainers penetrating housing. Conservative design allows at least ten starts per hour. Inherent cooling of motor by full effluent flow allows unit to pump continuously with motor above liquid level.
- C. Shaft, Stainless Steel. Upper bearing's sliding fit allows for shaft's heat expansion. High contact angle antifriction lower bearing.
- D Shaft seal. Precision engineered mechanical shaft sealing system incorporates independent double face seals with fungisten carbide faces running in oil for long life. Its compact proprietary design and practically zero leakage rate allows smaller oil housing resulting in short shaft overhang.
- E Liquid end. Semi-open multi-vane impetter is made of abrasion-resistant steel (50 Rc hardness). Synthetic rubber-clad wear plates are easily adjustable—or replaceable—to maintain original hydraulic performance. Hydraulically efficient diffuser design. Spock absorbing spring-cushioned strainer.
- F Shell. High-strength light-weight aluminum alloy housing. Static seals are leakproof 0-rings in precision-machined, sliding fit type grooves with controlled compression. All fasteners in stanless steel.



Power input and performance data

1816年でに、これにより、





Version

High Head Impeller Code 238 Phase 3¢ High Head Impeller Code 240 Phase 1¢ High Volume Impeller Code 244 Phase 3¢ High Volume Impeller Code 246 Phase 1¢

Technical specifications:

Service 1 Single Phase, 60 Hz

3φ Three Phase, 60 Hz

Rating (HP) 1 φ 4.5 3 φ 6.0

Voltage (V) 1 p 230

3φ 230/460 or 575

Current (A) 1φ21

3φ 15.4/7.7 or 6.1

RPM 1φ 3450

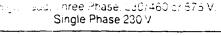
3φ 3450

Power Cable 50 ft of #10/4

Strainer 160 holes 1/4" × 11/2" each Oil specs 3.0 pints (1.41) 10W30

Controls:

Manual and automatic. Designed for rugged service with raintight (NEMA 3) enclosures and magnetic/hydraulic overload/breaker protection. For un-attended (automatic) operation the Flygt 8.408 level control, utilizing the ENH 10 level sensors and the solid state FPC-80 electronic controls are available. Ask for iterature.



			Lengt	n or alsen	arge :e		
Vertical Lift	Hose Size	100	Three Prus 2001	e 500°	.00.	ingle Phas 2001	500°
120'	3"		100	82	-	-	-
80 ,	3"	165	150	130	90	85	65
50'	3"	210	189	162	145	138	120
30,	3″	255	230	190	195	180	158
0,	3″		270	212	238	222	188

High Volume, Three Phase, 230/460 or 575 V. Single Phase, 230 V

Length of discharge nose								
Vertical Lift	Hose Size	100'	Three Phase 2001	500'	1001	ingle Phas 2001	e 500	
60'	4"	255	200	185	65	55	50	
45'	4"	265	250	212	178	165	150	
30'	4"	352	322	265	260	240	205	
15'	4"	415	380	315	323	300	260	
0'	4"	460	427	355	_	350	295	

Max. allowable cable extension lengths (ft)

(in addition to 50' supplied with pump)

	Ex	iension Caple S	iZ#		
Service Voltage*	Phase	#10	#8	* 0	#4
230 V	1φ	200	300	430	700
230 V	3ф	300	430	700	1100
460 V	3ф	1550	2200	3600	5600
575 V	3ф	1600	2300	3700	5800

^{*} Values shown assume full service voltage measured with pump running

Dimensions

Discharge connection	Wi inches	WI.	Wz inches	.V2	m nones	ri Timos	i eignt		Tandem
COMPCION	inches	111111	IIIC1183		1101.63	111.71		4 Ç	connection
3" High Hee 3" Hose connection	d 14¾	375	131/4	337	19 7/6	505	106	48	3" Hose connection
3"-8 NPSM (Male)" (Confined Speces)"	131/4	335	131/4	337	:9 ''∎	505	106	48	3"Hose connection
3"-8 NPSM (Male)	151/4	387	131/4	337	1974	505	.06	48	3" Hase connection
4" High Vol	100								
4" Hase connection	151/2	390	131/4	337	1974	505	:06	4ĉ	4" Hose connection
4*-8 NPSM (Male)	16%	430	131/4	337	191.	505	106	48	4" Hose connection

Optional

Low suction collar

A special rubber collar, is available for the BS 2095, which permits to pump down to floor level without sucking air.



FLYGT CORPORATION, 129 Glover Avenue, Norwalk, CT 06856. Tel. (203) 846-2051

Regional Offices: South San Francisco, CA (415) 873-0626. Atlanta (Norcress). GA (404) 448-0373

Milwaukee (New Berlin), WI (414) 784-2335. Dallas (Addison) TX (214; 233-1073)

Flygt Canada, 300 Labrosse Ava., Pointe Claire (Montreal) P.Q. H 9R-4V5, (514) 695-0100

[&]quot;Narrower to lit into contined spaces

Pump Performance (Water Sp. Gr. 1.0)

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(a) 35 60 (a) 4 (a	5	era y gi graje gila	2		:10	- '37	
(a) 40 15 2 25 25 2 42 55 (b) 68 20 7 5 (c) 785 30 30 35 (d) 75 48 75 75 14 55 (e) 785 30 30 35 (f) 70 30 30 40 50 35 (g) 70 30 30 40 50 30 30 40 50 40 50 50 50 50 50 50 50 50 50 50 50 50 50	: ۲۰۰۱		: E	50 - 45	25	3	
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(b) 58 7 - 7 - 50	×25 🚉		?	277		م يدوسود ا	مستريا والمتار
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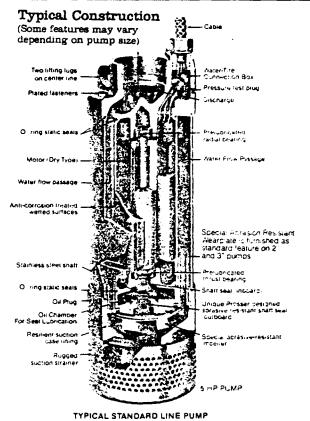
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Dimensions (Nominal)

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5HH	- 73/8	188	24	609	2"NPT(F)	3" Vict (m)	
31/2.8 SHV	724	188	22	-559	3" NPT (F)	3" Vict (m):	
10	.101/2	267	29	737	4" NPT (F)	5" Vict (m)	
15	> 101/2	267	. 31	787	4" NPT IP	45" Vict (m)	
25 & 40	12%	327	35	889	6" NPT (F)	6" Vict (m)	

Cable Information

	Sta.		60Hz A	NG Sizes	SOME AWG Sizes			
Pemp HP	Cable Langth	715V	230V	450Y	575V	220V	3807 4157-	
3/4 or 1 2 or 21/2	20 ft	14/4	14/4	14/4	14/4	14/4	14/4 14/4	
31/2 or 5	50 ft		12/4	12/4	12/4	12/4	12/4. 12/4	
10	50 ft	7	8/3/3 8/3/3	12/4	12/4		12/4 12/4	
25, 40	50 ft+	3	6/3/3	6/3/3	6/3/3 6/3/3		6/3/3 6/3/3 6/3/3 6/3/3	



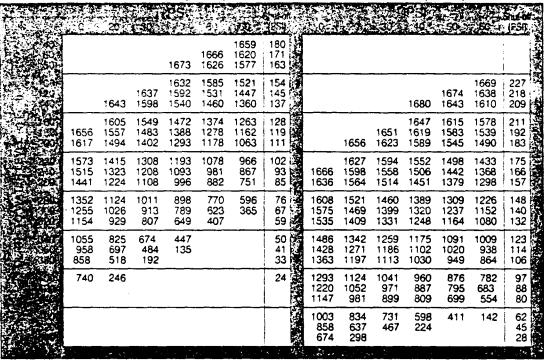
*Patented Prosser-designed silicon caro de aprasile- esistant ripe (\$1 shaft seal for extended service) te (2:40mP oumps)

SP 4 Selection Charts

RATINGS ARE IN GALLONS PER HOUR (GPH)

SP 4-19 (2 HP)

SP 4-26 (3 HP)



Friction losses in discharge pipe and fittings are not included in tables.

SP 4-36 (5HP)

SP 4-42 (5 HP)

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	1540 1506 1468	1455 1411 1363	1404 1355 1305	1348 1297 1244	1289 1236 1183	1228 1175 1122	184 175 167	10.00	1619 1601 1580	1574 1549 1522	1546 1517 1486	1513 1481 1445	1476 1440 1401	1434 1395 1353	246 238 229
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888 888 888	1118 1066 964	999 948 841	940 888 770	879 823 686	814 749 583	738 661 451	106 97 80	2	1350 1306 1216	1248 1202 1112	1195 1150 1061	1143 1098 1010	1091 1047 960	1040 997 908	168 160 142
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NOM, FLOW PATE
20 GPM
FLOW RANGE
11 to 28 GPM
PUMP OUTLET
11/2" NPT



WEEKLY WELL LOG

PAGEL PIT

"ELL #	DEPTH OF WELL	DATE	LEACHATE LEVEL	TIME PUMPED	DATE	LEACHATE LEVEL AFTER PUMPING
<u>-3</u>	49' 59'	8-25	46'	A.M.		46'
H-4	47' 62'	8-25	25'			
-5	50' 60'	8-25	27.6'	P.M.		44.6
H-6	491	8-28	26	A.M.		38′
7	42'	ļ				
8	28'					
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Ending 4

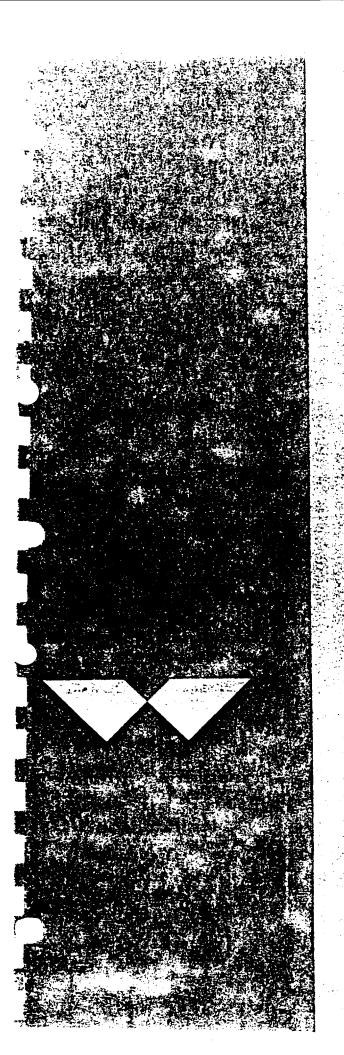
WEEKLY WELL LOG PAGEL PIT

4 h #	DEPTH OF WELL	DATE	LEACHATE LEVEL	TIME DUMPED	DAIR	LEACHATE LEVEL
1	331					
1-2	491					
3	46' 58 ,5'	8-25	22(3"	An.		58:5"
I - 4	43' 53 '	8-25	23	A.M.		<i>53′</i>
5	48'					
6	50'	8-28	25'4"	10:00 AM.	10:00 Am.	50'
1-7	481	8-28	32′	1:00 PM	1:00 P.m.	48'
8	41'					·
] - 1	35'					····
2 2	49'	8-28	31'6"	P.M	PM.	49
· _	46'	8-28	30	P.M	P.M.	46
J-4	38'					·
<u>K</u> 1	50'					
K-2	52'					
к 3	50'			le		·
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Pumping 609

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METHANE STUDY
WINNEBAGO RECLAMATION SERVICE INC.
PAGEL PIT LANDFILL
ROCKFORD, ILLINOIS

C 9078



Consulting Engineers • Civil • Structural • Geotechnical • Materials Testing • Soil Borings • Surveying

1409 EMIL STREET, P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

August 15, 1980 C 9078

Mr. Chuck Howard, President Winnebago Reclamation Service, Inc. 600 Boyleston Rd. Loves Park, IL 61111

Dear Mr. Howard:

Enclosed are five copies of our report, Methane Study, Winnebago Reclamation Service Inc., Pagel Pit Landfill, Rockford, Illinois. The report shows conclusively that methane migration away from the landfill in the vicinity of the Lyford, Baxter and Booth residences has been successfully controlled by the venting system you installed.

I will be in Rockford on Wednesday, August 20, 1980 at 10:00 a.m. to meet with you and Jim Hemberger to discuss this report and monitor the expanded venting system.

If you have any questions you want answered before I arrive on Wednesday, please call.

Very truly yours,

WARZYN ENGINEERING INC.

Steven G. Wittmann Project Manager

SGW/amh
[WEI D6-6]

cc: Jim Hemberger (1 copy)

METHANE STUDY WINNEBAGO RECLAMATION SERVICE, INC. PAGEL PIT LANDFILL ROCKFORD, ILLINOIS

INTRODUCTION

This study concerns the production, movement and methods of controlling anaerobic decomposition gases associated with the Winnebago Reclamation Service Inc. Pagel Pit Landfill. Approximately 80% to 90% of the gases generated within refuse are a combination of methane (CH4) and carbon dioxide (CO2). These gases are being produced within the existing refuse fill area at the Pagel Pit Landfill. It has been shown that these gases are not remaining within the refuse fill area where they are generated, but are migrating laterally through porous subsoils. Because of this lateral migration, infiltration of these gases into adjacent buildings becomes a concern.

Carbon dioxide is an inert gas about 1 1/2 times as dense as air.

Due to the relatively low possibility of carbon dioxide causing a safety hazard to nearby properties, this report will deal with the other major component of landfill gas, methane, and its potential hazards.

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Methane is a very reactive gas at high temperatures. In fact, it is the major component of the natural gas we burn as a heat source. The major concern with high concentrations of methane in a landfill environment is the danger to life and property from fire and explosion. Methane is combustible when in concentrations of 5% to 15% by volume in air. Concentrations



of methane monitored during this investigation within and adjacent to areas of past refuse disposal were in excess of the 5% lower explosive limit (LEL).

Initial site investigations found methane to be entering a structure owned by Winnebago Reclamation Service Inc. and utilized as rental property. Based on an initial site visit, it was recommended that permanent methane monitoring probes be installed both within the refuse fill area and adjacent to the fill boundaries to determine the extent of lateral migration of methane away from the refuse fill area.

As the methane gas exits the refuse disposal area either in underground soil layers or through the surface of the fill, it must pass through the explosive 5% to 15% range as it is diluted with air. In most circumstances a combustion ignitor is not present when the methane reaches the flammable range. However, this is where the danger lies for buildings built on or near the refuse disposal area.



HISTORY

Winnebago Reclamation Service Inc., obtained a license to operate a 60 acre asphalt lined sanitary landfill located south of Rockford, Illinois, in 1972. Initial solid waste projections estimated that approximately 125,000 tons of refuse per year would be disposed of. Total capacity of the landfill is two million cubic yards.

Warzyn Engineering Inc., was contacted in March, 1980 after Winnebago Reclamation Service Inc., learned that methane was entering the foundation of adjacent structures. An investigation was outlined and initiated to determine if that methane was migrating away from the landfill and if so, what preventative measures could be taken.



PURPOSE

The purpose of this report is to document subsoil conditions encountered during installation of the permanent methane monitoring probes, describe installation techniques and procedures used during the field investigations, obtain methane concentrations beneath the surface soils, and make recommendations for remedial measures which can be taken to alleviate the methane problem. This report is not required by any regulatory agency, rather it is being prepared at the request of the Winnebago Reclamation Service Inc.

The methane investigation was initiated during March of 1980. From that point until July, 1980, periodic monitoring took place in the permanent methane monitoring probes installed in and adjacent to the refuse fill area and in adjacent buildings. The purpose of obtaining methane readings for this extended period of time was to determine if methane concentrations vary during seasons of the year when they actively vent through the granular surface soils and when they are sealed beneath the frozen ground. The data obtained during this periodic monitoring was utilized to define the extent of lateral migration of methane and the areas of highest methane concentration.

As a precautionary measure, Winnebago Reclamation Service Inc. installed exhaust fans in the basements of the two rental properties which they own immediately adjacent to the refuse fill area.



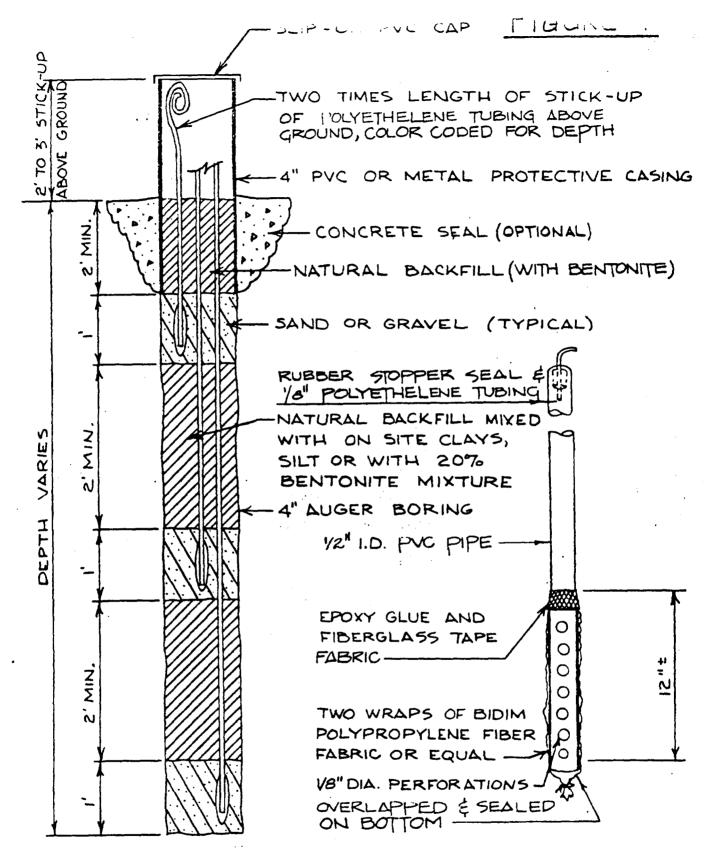
INVESTIGATION

The installation of the methane monitoring probes was conducted in a two stage program. A benefit of this two stage program was that data obtained during the first probe installations could be utilized to determine the most advantageous placement of the remaining probes. Nine of the twenty-four probes were installed on March 5, 1980. The remaining probes were installed on March 6 & 7, 1980. See Drawing C 9078-1 for a location map of the methane probes.

Installation of the permanent methane monitoring probes was performed by a mobile soil boring rig. A log of the subsurface materials encountered was recorded to determine types and thicknesses of soil deposits and refuse encountered. See Appendix A for logs of subsoil materials encountered at the monitoring probe locations. One to three monitoring probes were installed at varying depths within each soil boring. Figure 1 depicts a typical permanent methane monitoring probe. The installation procedure utilized allows the monitoring probes to be set at specific depths where changes in soil texture take place or within pockets of refuse.

The depths of the probes within the soil borings are determined by the type of soil materials present at each location. If a silty or clayey soil layer was encountered, a probe was installed immediately beneath that layer if possible, to determine if methane was being trapped beneath it in more porous granular layers. Each probe tip was backfilled with granular material to keep the intake openings from being plugged. Bentonite seals were installed above and below the monitoring probe tips to limit methane migration up the soil boring hole and insure that specific soil horizons were being monitored.





TYPICAL DETAIL
JESTED GAS MONITORING WELL

TYPICAL DETAIL

GAS MONITORING PROBE

NOT TO SCALE

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Each nest of monitoring probes is protected at the surface with a 2 - 3 foot section of 4" PVC pipe. Methane readings are obtained from 1/8" diameter tubing inserted into the monitoring probe. In cases where more than one probe is installed, the 1/8" tubing is color coded according to depth.

Methane concentration readings are obtained by attaching the intake of the methane meter directly to the probe. An initial reading is obtained from the probe, then the probe is purged and checked again. This method of testing enables methane, which may be present in the soil in very low concentrations, to be detected if it has concentrated at the probe tip. The second reading is an accurate check of the actual methane concentration.

Because of the detected methane in and around the structures adjacent to the landfill on Lindenwood Road, the majority of permanent monitoring probes were installed in that area. Four permanent probes were installed within the refuse fill area to document methane concentrations within that refuse and the effect of future remedial action.

Generally, subsoil conditions encountered consist of deposits of sands and gravels, sometimes inter-mixed and sometimes in relatively uniform deposits, overlain by 1 - 3 feet of siltier soil. Bedrock was encountered at shallow depths east of Lindenwood Road in the vicinity of the Lyford house.

After installation of the permanent monitoring probes, a monitoring program was initiated to document whether methane concentrations varied between winter and summer climatic conditions. It was anticipated, that the frozen surface soil conditions present during the winter months would inhibit methane migration out of the surface soils causing the concentration to build in the subsoils and result in the greatest lateral migration of the landfill gases. As the surface soils thaw during the Spring, the



soil is still saturated, reducing the ability of methane to vertically migrate out of the surface soil. As soon as the surface soils have thawed and have sufficiently dried, the landfill gases can vent through them. To define this seasonal fluctuation, methane readings were obtained in the permanent monitoring probes during the initial installation of the probes on March 5 - 7 upon completion of the installation of the probes on March 11, and on April 2, May 23, and June 13, 1980. The results of the monitoring are shown in Table 1.



METHANE TESTING PAGEL PIT LANDFILL C 9078

TABLE 1

Probe	Probe	Depth		Percent !	Methane In	Air			
No.	Color	(Feet)	3-5-80	3-6-80	3-7-80	3-11-80	4-2-80	5-23-80	6-13-80
G1	Red	23	43	47		50	13	38	38
	Clear	5	40	43		54	20	30	30
G2	Red	13	6	50		51	49	46	46
	Clear	6	1	47	1	52	50	46	45
G3	Red	17.5		18			42	43	41
	Clear	8.5	46	44			50	47	49
G4	Red	13 5	62				- 60		
	Clear	5	56				56		
G5	C1 ear	17	46	52		42	56	→	
G6	Red	15 5	50	51		41	50	45	0
	Clear	5	38	50		50	50	43	0
G7	Blue	7	51			~ ~	52	43	
	Clear	17	49	50		50	51	46	
G8	Red	29	54	53			52	46	4
	B1 ue	11 5	52 32				51	44	1.4
	Clear	5	32	55		, 48	52	45	0
G9	Red	17	12 0			32	38	36	0
	Clear	7	0	40	***	43	40	16	0
G10	Red	15		~-	48	50	0.6	0	0
	Clear	6			48	51	0	0	0
G11	Red	9 5	~~		0	0.8	0.1	0 0	0
	Clear	5			. 0.8	1.4	0	0	0

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Probe	Probe	Depth		Percent	Methane In	Air			
No.	Color	(Feet)	3-5-80	3-6-80	3-7-80	3-11-80	4-2-80	5-23-80	6-13-80
•					,				
G12	Red Clear	8 5			0 0.8	0	0.4 0.1	0 0	0 .
G13	Red Clear	10 5	 		2.5	0.8 0.3	1 0.2	1.8 1.4	0 1.4
G15	Red Clear	12.5 5			4.5 0	0.3 0.2	0	0 0	0 0
G16	Clear	5	••		14	24	. 8	0	0
G17	Clear	12	. 		4.5	4.5	0	0.4	0
G18	Clear	4			22	22	3	0	0
G19	Clear	6		••	18	34	4	0	0
G20	Clear	7			0.4	0.3	0.8	0.4	0
G21	Clear	14	<u> </u>		2.5	0	0	0.1	0.1
G22	Clear	18	•••	•• ••	0	0	0	0	0
G2 3	Red Clear	10 5.5			0 0	0	16 . 3	28 18	0 0
G2 4	Clear	10		÷.	0	0	.3	0	. 0

⁻⁻ Indicates Methane Reading Not Obtained

ANALYSIS

To document methane concentrations within the refuse fill area, methane probes G3, G4, G5 and G7 were installed within the refuse at varying depths. Typical methane concentrations within the refuse fill area range from 41% to 60%. Methane probes G6, G8, and G9 were installed immediately outside of the refuse fill area from 5' to 29' below the surface to document methane concentrations within the varying subsoil layers.

Probes G1 and G2 were installed on both the north and south sides of the Winnebago Reclamation Service Inc., rental property (Chelise House) because of high methane concentrations detected within the foundation of this structure on previous occasions. Methane concentrations in the subsoil at probes G1 & G2 varied from 13% to 50% during the investigation. During each of the on-site investigations, the methane concentration within the Chelise House was checked to determine if a potential hazard existed. Methane was detected infiltrating into the foundation at various locations during every investigation. The over-all methane concentration in the atmosphere of the house was at a maximum of 1.5% (30% LEL) on March 11, 1980. Upon notification of this situation, Winnebago Reclamation Service Inc. evacuated the house and it has remained vacant since that time.

The remaining probes G10 - G24, were installed to document the extent of the lateral migration of methane away from the refuse fill area.

Methane monitoring probes G10 - G13 were installed in the vicinity of the Winnebago Service Inc., rental property (Booth House) and documented that methane was present in the subsurface soil near the house. Investigations performed in the Booth House basement did not detect any methane infiltrating into that foundation.



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Methane probes G15 and G16 were installed east of Lindenwood Road near the Baxter residence. Both of these probes showed inconsistent readings during all of the monitoring periods. G15 ranged from 0% to 4.5% and G16 ranged from 0% to 24%. The Baxter residence was investigated for the presence of methane on March 11, 1980. Methane was not detected infiltrating into the Baxter residence foundation.

Methane probes G17 - G23 were installed in the vicininty of the Lyford residence which is located east of Lindenwood Road. In the installation of methane probes G18, G19, G20 and G23 dolomite bedrock was encountered at from 5' to 10' below the surface. Methane was detected in relatively high concentrations (20% to 34%) in the soil layers immediately above the bedrock surface.

Analysis of the data collected up to this point from the probe installation concluded that methane may be migrating away from the refuse fill area through fractures in the upper layers of the dolomite bedrock. To verify this hypothesis, an air drill used for drilling through rock was utilized to penetrate the bedrock to a depth of 20' at three locations between Lindenwood Road and the Lyford residence. Methane readings were obtained every 10' during the rock boring and showed no methane to be present in the rock layers. This verified that methane detected in methane probes G18, G19, G20 and G23 was migrating off-site above the surface of the bedrock.

The water supply well at the Lyford house had a methane concentration within the well casing of from 43% to 57% during the first five monitoring periods. The high concentrations of methane in this well casing was part of the reason for believing that methane was migrating through the fractured dolomite bedrock. However, the construction of the well is not well documented and it is possible that the casing does WARZYN

not extend into the bedrock. This would allow the methane to migrate into the casing above the bedrock at that point.

The methane monitoring probes G17, G21 and G22 were installed east of the Lyford and Baxter residences to document if methane detected in the subsoil layers might be migrating from some unknown source east of the Pagel Pit Landfill. A trace of methane was detected in those probes during the monitoring periods. The presence of the fluctuating trace level methane concentrations in these probes and in several of the other probes indicated that there may be other reasons for the methane meter fluctuation while monitoring these probes.

A possible reason for the methane meter fluctuation in some of the monitoring probes is the use of PVC cement utilized to join the probe tips to the other sections of pipe and also to join several sections of the pipe where required. The PVC cement contains volatile substances which when vaporized cause the methane meter to deflect, indicating erroneously that methane is present. As the glue hardens, and the vapors dissipate, readings are not affected. Since not all of the probe tips require cementing, this would explain why some of the probes, do not show this initial meter deflection. In areas of higher methane concentrations in the subsoil, this minor deflection is not noticeable because of the higher methane readings obtained. This theory has recently been substantiated on another methane investigation conducted adjacent to a landfill in Wisconsin. The probes which may be affected in this manner include, GII, GI2, GI3, GI5, GI7, G20, G21 and G24.

From the data obtained during the monitoring periods it was evident that methane is migrating away from the refuse fill area north towards to the Chelise house, east towards the Baxter and Lyford houses



and south towards the Booth house. Subsurface probing north of the refuse fill area in the vicinity of the Scale house did not detect any methane to be present. The west side of the landfill was not investigated because of the lack of development.

Upon notification of the high methane concentrations in the subsoil adjacent to several of the existing structures near the landfill, Winnebago Reclamation Service Inc., initiated efforts to minimize the lateral migration of methane away from the refuse fill boundary. After consultation with Warzyn Engineering Inc., Winnebago Reclamation Service Inc., designed, installed and is now operating a methane venting system in the southeastern corner of the refuse fill area.

Venting wells V1 V5 shown on the attached Drawing C 9078-1 were installed on March 27, 28 and 31 and April 1, 1980. The venting wells were constructed by drilling a 15" diameter hole from the surface of the refuse to within 3' of the base of the landfill. A perforated 4" diameter PVC pipe was installed in the center of the hole and the hole was backfilled with A-stone backfill (1" - 1 1/2" diameter) to within 5' of the surface of the landfill. The last 5' was backfilled with a cohesive soil. The five venting wells were connected to a 6" diameter PVC header pipe which was connected to a high pressure blower. The blower is an AEROVENT high pressure, drawing 20" of water pressure, 750 CFM blower with a 5 hp single phase motor. The blower draws the landfill gases out of the refuse fill area and exhausts them to the atmosphere via a 6" diameter vent pipe.

On May 23, 1980 a complete round of methane samples was obtained in all of the methane menitoring probes and in the Lyford drinking water well.

Methane, carbon dioxide and oxygen concentration readings were obtained



in the exhaust vent prior to start-up of the blower. Similar readings were obtained 15 minutes after start-up, 1 1/2 hours after start-up and 2 hours after start-up. The Lyford drinking water well was checked 1 hour after start-up and 2 hours after start-up. The following table depicts the concentrations of gases present at the various times.

TABLE 2

GAS CONCENTRATION
VENTING SYSTEM
May 23, 1980

GAS	BEFORE	1/4 Hr.	1 1/2 HOURS	2 HOURS	
METHANE (CH4)	44%	43%	42%	42%	
CARBON DIOXIDE (CO2)	40%		36%	32%	
OXYGEN (O ₂)	3%	3%	2%	2%	
	GAS CONCENT LYFORD Way 23,	VELL - Street			
GAS		dunt :	2 HOURS	• '	
METHANE (CH4)	455	100 and 100 per 100 and 100 an	0%		

It is evident from the previous table that the venting system is relatively air tight. The stable oxygen readings obtained before and during operation indicate that air is not being drawn into the system at any of the pipe joints or through the cover soils in the immediate vicinity. As expected, the methane concentration is remaining relatively high during the initial start-up period. As the venting system is operated, we expect that the methane concentration will be lower. Also shown in Table 2 is the effect that start-up of the blower system had on the Lyford



drinking water well. The 45% methane concentration present before startup was reduced to 0% after a 2 hour period. The time period involved may have been less than the 2 hours shown.

Upon finding that the blower had such a drastic impact on the methane concentration in the Lyford drinking water well in such a short period of time, the blower was turned off to see if the methane concentration in the drinking water well increased. After the blower was off for 1 hour, the methane concentration in the Lyford drinking water well was 18%. The blower was turned on again and within 10 minutes the methane concentration in the drinking water well was reduced to 0%.

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Similar findings were obtained in several of the methane monitoring probes adjacent to the methane venting system. Monitoring probe G6 was reduced from a 50% methane concentration prior to start-up of the blower to 0% after 1 1/2 hours of blower operation. Methane probe G8 had a reduced concentration in the deep probe from 52% to 8%. The probe installed 11' below the ground at G8 was reduced from 51% to 42% and the shallow probe was reduced from 52% to 48%.

Sampling was conducted on June 13, 1980 to verify the continued methane venting capabilites of the venting system. The blower had been in operation 8 hours per day for a two week period. It was found that the venting system was continuing to lower methane levels within the adjacent methane monitoring probes. The methane concentration in Probe G8 was lowered to near 0% in all three depths being monitored. Probe G6 remained at 0%, G7 was lowered from 43% to 0% and G 23 was lowered from 28% to 0%. No detectable levels of methane were found in the Lyford drinking water well. To make a final determination as to whether the



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blower was having an impact on the methane concentrations in the drinking water well, the methane venting system was shut off during this sampling period. After a period of 1 hour the methane concentration within the drinking water well casing was 10%. Within 3 minutes of turning on the blower, the methane concentration was reduced to 0%.

Methane probes G1 and G2 in the vicinity of the Chelise house were not affected by the installation and operation of the methane venting system. During the May 23 and June 13 samplings, methane concentrations remained in the 30% - 40% range in those two probes. However, as is shown on Table 1, the remaining areas outside of the refuse fill limits where methane probes have been installed have been successfully evacuated of methane in the subsoil layers.



CONCLUSIONS

- 1. Methane is being generated within areas of past refuse filling. Evidence of this is found in monitoring probes installed within this area. Methane concentrations typically are in the 40%-60% range.
- 2. Methane has been detected in adjacent structures up to 300 feet from the edge of the refuse fill.
- 3. Subsoil conditions encountered outside of the refuse fill limits, (sands & gravels) allow lateral migration of decomposition gases to occur.
- 4. The methane monitoring program was conducted over a four month period in the Spring and early Summer of 1980. It showed that methane concentrations did not vary substantially during the period prior to installation of the methane venting system.
- 5. Data collected during the subsoil investigation and monitoring period indicates methane is migrating away from the refuse fill area.
- 6. Winnebago Reclamation Service Inc., initiated positive efforts to control lateral migration of methane upon notification of results of the investigation.
- 7. Methane monitoring on May 23, 1980 and June 13, 1980 indicated that the methane venting system installed within the refuse fill limits had an immediate impact on detected methane concentrations in the vicinity of the Lyford residences.
- 8. This report shows conclusively that the methane venting system installed is controlling methane migration away from the refuse fill area in the vicinity of the Lyford, Baxter and Booth residences.

RECOMMENDATIONS

CAT WITH BUILDING WITH

- 1. The active forced induction gas control system already installed should remain in operation year-round.
- 2. After methane levels have stabilized it may be possible to operate the venting system on a periodic basis.
- 3. The methane venting system should be expanded to include the refuse fill area adjacent to the Chelise house. As of the date of this report, Winnebago Reclamation Service Inc., has expanded the methane venting system to include this area. No testing has been conducted to verify its effectiveness.
- 4. Periodic testing of methane levels in the probes, venting system and adjacent structures should be conducted.



CLOSING REMARKS

Upon notification of the methane migration problem Winnebago Reclamation Service Inc., initiated immediate efforts to identify the source, define its movement and eliminate the problem. Their effort has resulted in the removal of methane from areas which may cause a hazard.

Submittal of this document to the regulatory agency or agencies which have jurisdiction over the sanitary landfill will document Winnebago Reclamation Service Inc., efforts to maintain an environmentally sound landfill operation.

If you have any questions regarding this report, please contact us.

Very truly yours,

WARZYN ENGINEERING INC.

Steven G. Wittmann Project Manager

SGW/amh
[WEI D6-6]



APPENDIX A

LOGS OF METHANE
MONITORING PROBES

LEGEND

TOPSOIL



FINE SAND, TRACE GRAVEL



COARSE SAND AND GRAVEL



SILTY LOVER



REFUSE



BEDROCK



SILTY CLAY



FINE SAND.



COARSE GRAVEL

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GAS PROBE WITH DEPTH



ENGINEERING INC

LEGEND

Pagel Pit Landfill Winnebago Reclamation Service Inc. Winnebago County, Illinois

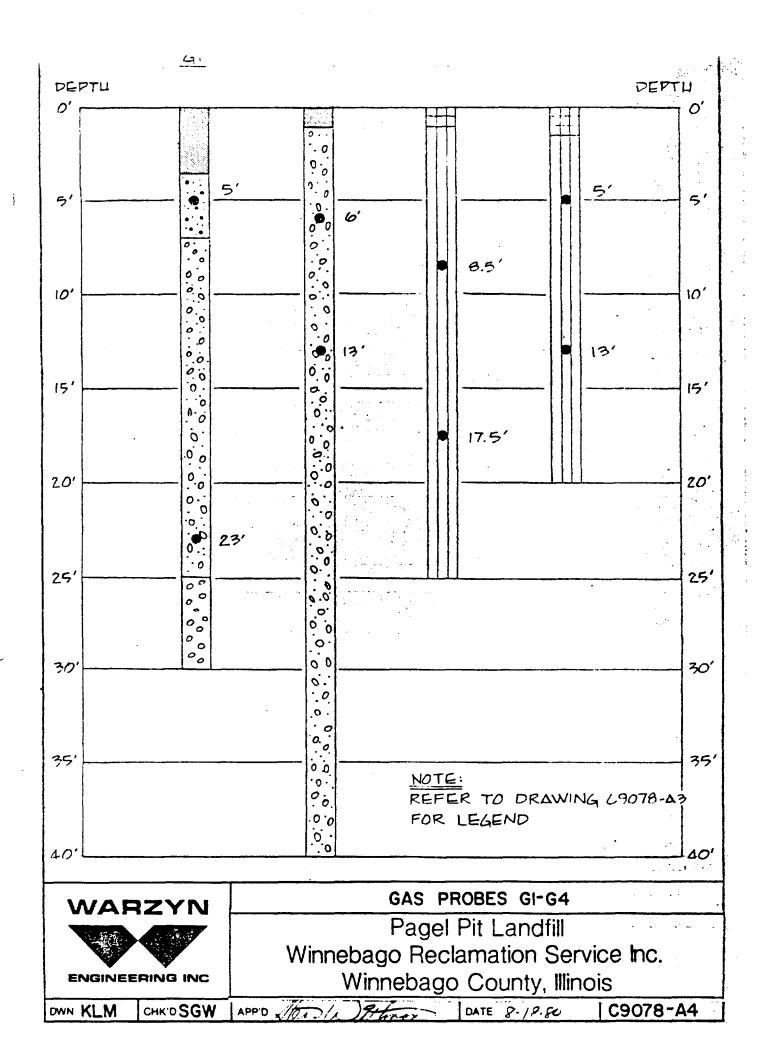
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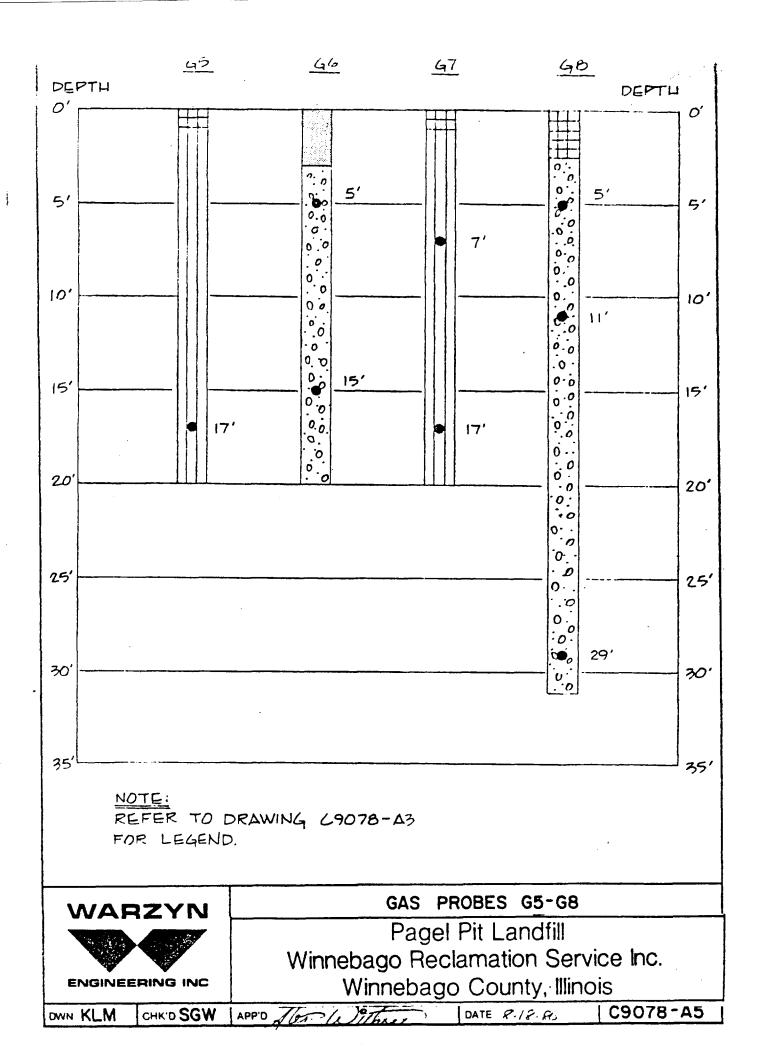
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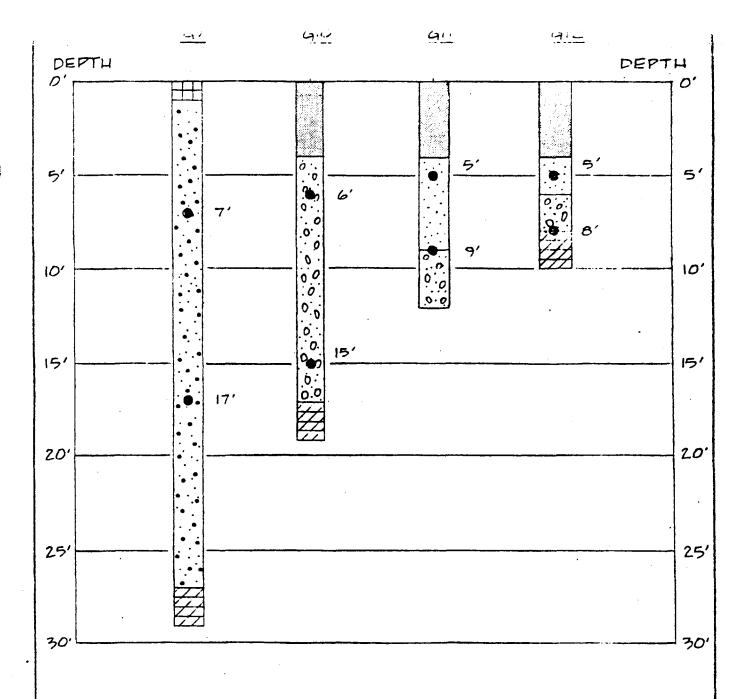
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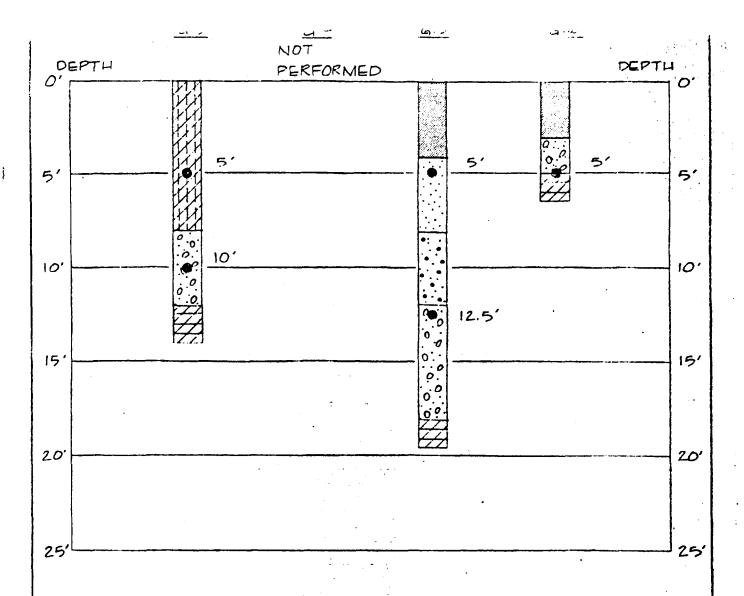
NOTE: REFER TO DRAWING C9078-A3 FOR LEGEND.



GAS PROBES G9-G12

Pagel Pit Landfill Winnebago Reclamation Service Inc. Winnebago County, Illinois

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NOTE: REFER TO DRAWING 69078-A3 FOR LEGEND.



GAS PROBES GI3-GI6

Pagel Pit Landfill Winnebago Reclamation Service Inc. Winnebago County, Illinois

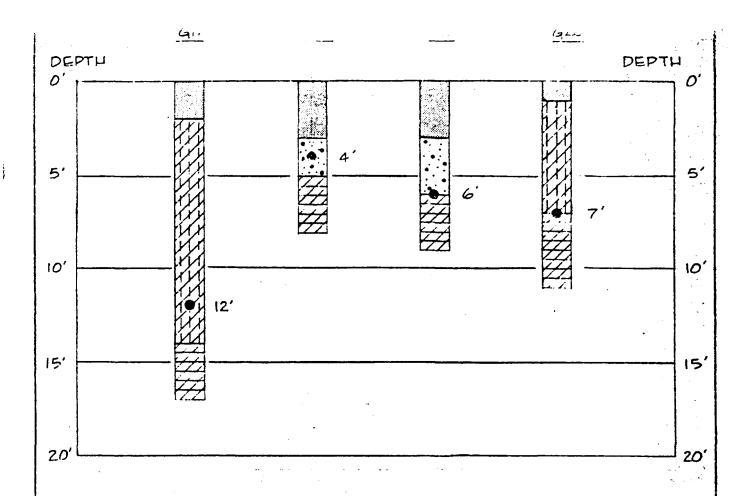
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NOTE: REFER TO DRAWING L9078-A3 FOR LEGEND.



GAS PROBES G17-G20

Pagel Pit Landfill Winnebago Reclamation Service Inc. Winnebago County, Illinois

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NOTE:
REFER TO DRAWING C9078-A3
FOR LEGEND.



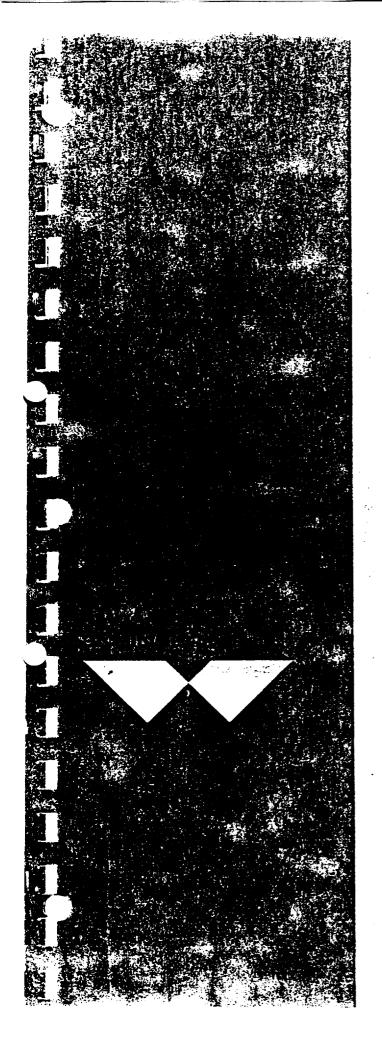
GAS PROBES G21-G24

Pagel Pit Landfill Winnebago Reclamation Service Inc. Winnebago County, Illinois

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PAGEL PIT LANDFILL STUNTED VEGETATION & METHANE INVESTIGATION

C 9078



Consulting Engineers • Civil • Structural • Geotechnical • Materials Testing • Soil Borings • Surveying

1409 EMIL STREET, P.O. BOX 9538, MADISON, WIS. 53715 • TEL. (608) 257-4848

October 5, 1981 C 9078

Mr. Chuck Howard, President Rockford Blacktop Construction Co. 600 Boyleston Road Loves Park, IL 61111

> Re: Pagel Pit Landfill Stunted Vegetation & Methane Investigation

Dear Mr. Howard:

Enclosed is our report entitled, Stressed Vegetation and Landfill Gas Investigation, Pagel Pit Landfill, Rockford, Illinois. From the investigation, analysis and conclusions outlined in the Report, it is evident that landfill gas migration from the landfill has impacted offsite property. By implementing the short and long-term recommendations included in the report, migration of those gases can be reduced.

We are available to meet with you to further discuss landfill gas migration and control from the Pagel Pit landfill.

Very truly yours,

WARZYN ENGINEERING INC.

Steven G. Wittmann Project Manager

SGW/cgj [WEI-9-32]

cc: Jim Hemberger w/encl.

STRESSED VEGETATION AND LANDFILL GAS INVESTIGATION PAGEL PIT LANDFILL ROCKFORD, ILLINOIS C 9078

Following your request, we have performed a field investigation of specific areas both on and adjacent to the Pagel Pit Landfill. The investigation took place on September 4, 1981, when Steve Wittmann of Warzyn Engineering Inc., met with Jim Hemberger at the landfill site. The specific purpose for the field investigation was to investigate an area of stunted corn located west of the scale house, immediately adjacent to the Pagel Pit Landfill property line.

The areal extent of stunted vegetation was readily apparent in that the healthy/stunted vegetation border was sharply delineated. Closer inspection of the impacted area showed that the stunted corn was present primarily on a small rise in topography which characteristically had coarse gravel and cobbles present at the surface. The surrounding soils in the corn field did not exhibit this characteristic. Jim Hemberger used a shovel to dig a shallow trench approximately 8 to 10 inches deep extending from the healthy corn area into the area of stunted corn. The surface soils in this shallow trench were darker, more moist and had a very pungent odor as the stunted vegetation area was encountered.

To determine if decomposition gases which are generated within the landfill limits are the cause of the poor growth in vegetation, several probes were made into the subsoil area to determine the methane concentration. The probes varied in depth from 6 inches to approximately 30 inches. A methane concentration of over 30% was detected in each of the probes.



The lawn area immediately west of the scale house and adjacent to the impacted corn field was then checked for the presence of methane in the surface soil. No trace of methane was detected in the lawn area that was checked.

Upon detecting the high methane concentrations in the stunted corn, methane concentrations were then checked in the surface soil along the northern periphery and sideslopes of the landfill. Drawing C 9782-2, included with this report depicts approximate locations of the general areas of high methane concentrations in the surface soils which were detected during the October 4, 1981 investigation. The map indicates that methane has migrated northward from the refuse fill limits as far as 300 feet from the refuse fill boundaries. In most areas of high gas concentration in the surface soils, vegetation was either sparse or entirely lacking. Numerous trees and shrubs east of the scale house area appear to have been impacted by landfill gas present in the subsoils.

The area immediately surrounding the scale house was checked to determine if methane infiltration into that building posed a problem.

Methane was not detected within the scale foundation or in the subsoils immediately adjacent to the building.

During the surface probe investigation, another area of impacted corn was located on the north side of Lindenwood Road, approximately 300 feet east of the Chelise house. See Drawing C 9078-2 for approximate location of that area.

The methane venting system installed on the southeast corner of .

the landfill was then checked to determine if it was continuing to

evacuate decomposition gases from the landfill. Prior to shutting off the



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blower, a 20% methane concentration was detected in the exhaust of the system. After the blower was shut off for 15 minutes the methane concentration passively venting out of the system increased to 32%.

An inspection was made of the entire venting system, header pipes and venting wells with several problems being noted. Water vapor was condensing within the header system faster than current maintenance practices provide for draining it off. At every condensate drainage point, a large volume of water was drained from the pipe when the valve was opened. In several cases, the volume of water contained within the header pipe may have been sufficient to impare the system's effectiveness. In addition, the header pipe between Venting Well V7 and V8 was completely split apart allowing for air to be drawn into the system, thus severely restricting venting capability which may have been provided by Venting Wells V8 and V9.

Methane concentration in permanent monitoring probe G-8 was also checked and a trace was detected in the deepest probe tip. Similar findings have been recorded in this monitoring probe since the installation of the venting system.

Based on the information gathered during the field investigation and analysis of previously obtained data, several conclusions can be drawn:

- Refuse decomposition gases are migrating north and northeast from the northern refuse fill boundaries.
- 2. Stunted corn, visible in the field immediately west of the scale house has been impaired by landfill decomposition gases.
- Numerous small patches of grass and miscellaneous trees and shrubs north of the refuse fill limits on Rockford Blacktop property have been impacted by refuse decomposition gases.



- 4. A small area of corn northeast of Lindenwood Road has been impacted by the presence of refuse decomposition gases.
- 5. The methane venting system consisting of the original five venting wells and associated header pipe appears to be controlling methane migration from the fill limits in the southeast corner of the landfill.
- 6. Venting Wells V6 through V9 are apparently not providing adequate venting capability along the northeastern and northern boundary of the landfill.
- 7. From the data obtained to date, it is not apparent whether methane gas detected in the corn field to the west of the scale house is exiting the landfill east of the scale house and then migrating westward; or whether the gas is moving directly northward from the entire northern refuse fill boundary.

The above conclusions point out a problem in defining the extent of the present problem and the need for additional information. The following recommendations will provide direction in performing both short-term remedial measures and long-range planning to help alleviate future problems.

- 1. The first and most important short term recommendation is to repair and maintain the existing methane venting system to achieve the maximum potential for extraction of gases from the landfill.
 - a. The split in the header pipe along the northern extremity of the venting system should be repaired with a flexible rubber collar.
 - b. A maintenance program should be established to drain the condensate from the header pipe on a frequent basis to eliminate water buildup within the system.
 - c. A more permanent solution to draining the valves on a periodic basis would be to redesign the lateral hookups from the venting wells to the header system. The tee-connection in the header pipe should be repositioned so that the lateral hook-



up is located on the bottom of the header pipe. The lateral should be sloped downward into the venting well to allow condensate to drain back into the well system and not accumulate in the header pipe. Some manual drainage of condensate may still be required depending on the slope of the system in relation to the wells.

- d. It would be beneficial to install valves on each of the wells so that part of the system could be shut down and maximum extraction could be obtained from the remaining wells. This would aid in determining the affectiveness of venting wells V6 through V9 prior to initiating any effort to relocate those wells.
- 2. After the above maintenance measures are performed, methane concentrations should again be checked in the surface soils north and northeast of the refuse fill boundary to determine if operating the system at maximum efficiency in that area has an impact on landfill gas migration.
- 3. If the maintenance procedures outlined above do not substantially decrease the methane concentrations detected in the surface soils north and northeast of the refuse fill boundaries, alternatve locations for Venting Wells V-6 through V-9 should be considered. Since these wells were apparently installed in an area of past sludge placement, they may not be providing the venting capability necessary to create a vacuum in this area. It is not certain at this time whether those venting wells should be relocated within the refuse boundaries or immediately adjacent to the refuse fill boundary to provide maximum gas venting capability.
- 4. To better define the extent of methane migration along the entire northern boundary of the fill area, additional methane monitoring probes are recommended to be installed. Information obtained from additional probes would aid in defining whether the landfill gas is exiting the fill area along the entire northern boundary or whether it is exiting north of the fill limits behind the Chelise house and then migrating westward toward the corn field.



5. If it is determined that methane is migrating northward from the entire northern fill boundary, consideration should be given to relocating the pressure blower unit to a location near Venting Well V-9 and extending the venting system westward to control that lateral migration. A complete systems analysis should be performed prior to initiating such a relocation so that adequate venting capability is provided in the southeast corner of the landfill where the blower is now located.

In summary, we have detected refuse decomposition gases migrating away from the refuse fill limits in areas where the venting system has been installed to control that migration, and in areas which were not planned for in the design of the system. Since the migration of gases is impacting adjacent properties not owned by Rockford Blacktop Construction Co., remedial measures should be initiated to control that migration. The maintenance procedures suggested for the existing venting system may produce some positive results in locations that the system was designed to control.

System redesign or expansion must be considered to control migration which is occurring north and west of the existing venting system. If system expansion is decided upon, the potential for utilization of the collected methane as a heat source to further evaporate leachate or for any other economically feasible alternative could be considered. We would be pleased to meet with you at your convenience to discuss the conclusions of this report and recommendations for remedial measures. If you have any questions, please feel free to call.

Respectfully submitted,

WARZYN ENGINEERING INC.

Steven G. Wittmann Project Manager

SGW/cgj [WEI-5-42]



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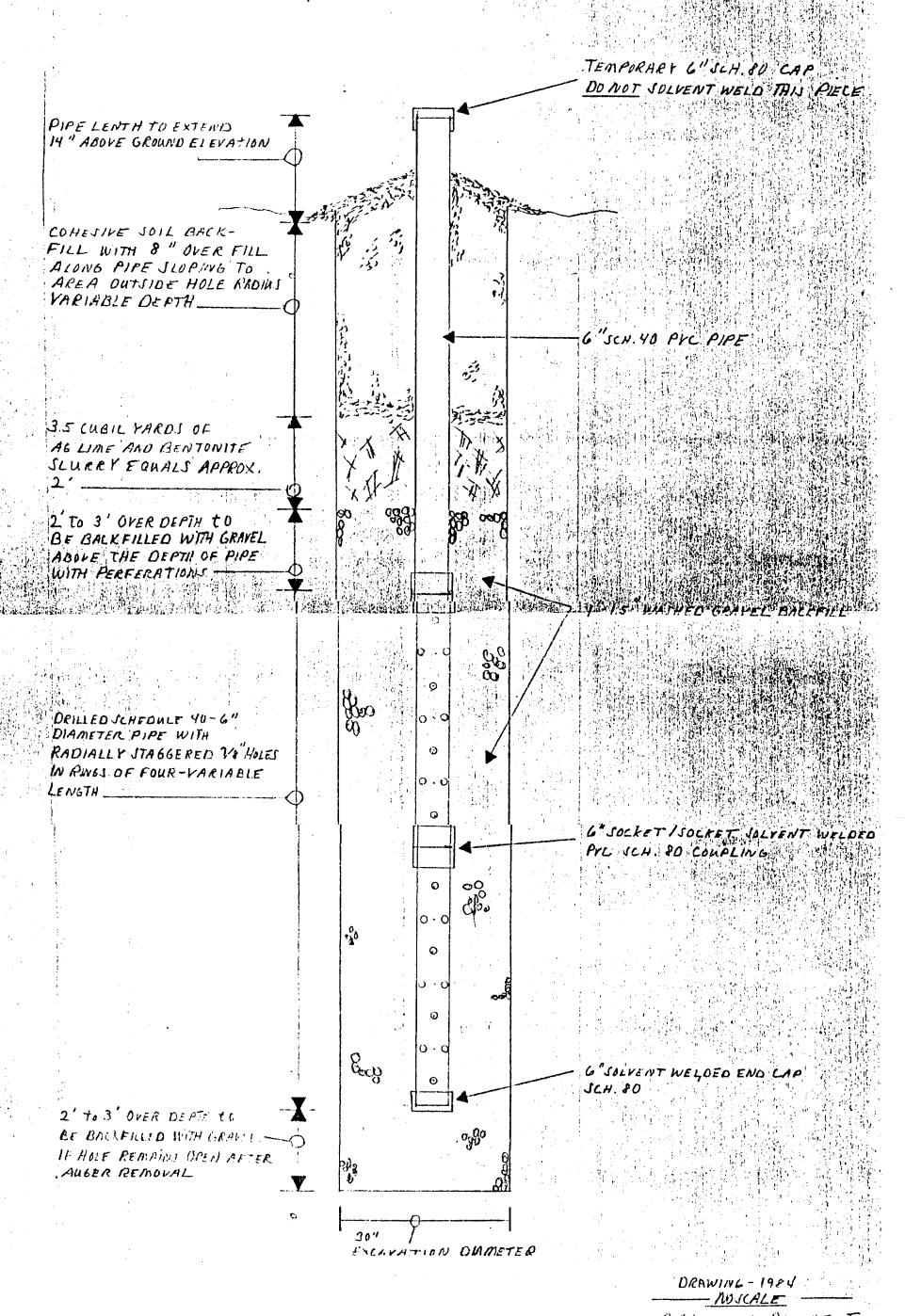
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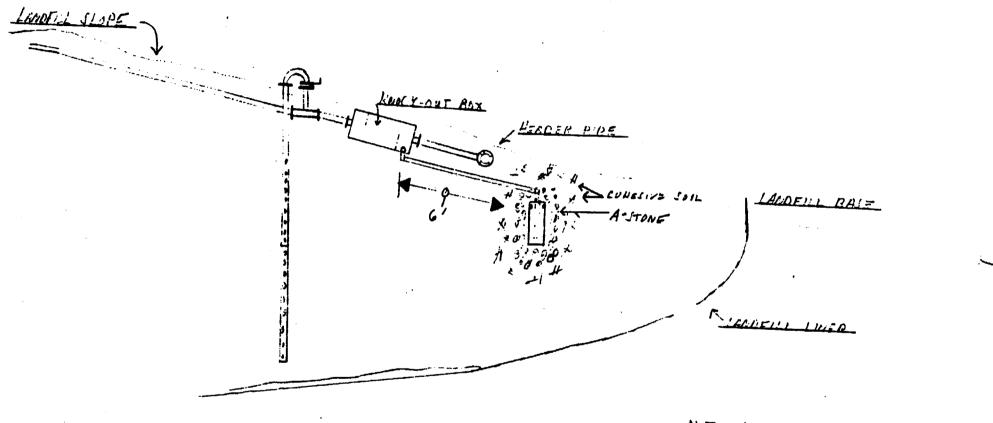
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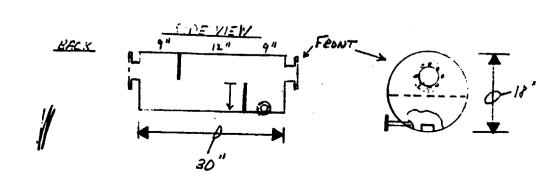


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